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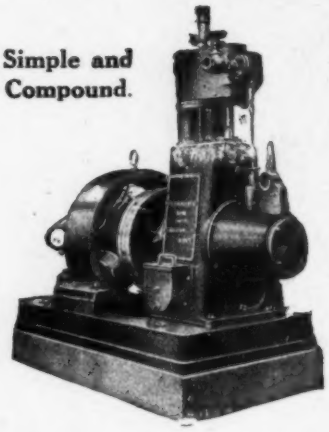

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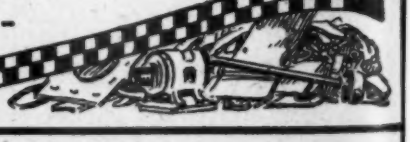

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ELECTRICAL REVIEW.

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REMUNERATION IN BRITISH COMMERCE: AT HOME AND ABROAD.

SEVERAL weeks ago we commented here upon the need for employing the most suitable and efficient type of man to represent British manufacturers in Brazil. We are led to return to the subject of our representation out there by a report which was recently sent home by the Acting British Consul at Sao Paulo. The point raised by this official is not so much that of securing new men to send, or that of efficiency in representation; what he is anxious about is that those British agents who are there already, and know the ground so well, should not be lost to British interests through an incomplete knowledge on our part of the present situation. It seems that we are losing to American employers in Brazil, British men who hold important local positions such as managers and sub-managers. That he cannot have one or two isolated cases in mind is obvious from his remark concerning "the exodus of Englishmen from British to American firms." We gather that the businesses that are incurring this loss are firms having head offices in England which, judging by their actions, are out of touch with present-day conditions and cost of living. Possibly it is some years since their directors or principals went out to investigate the market, and their views then gained are of little value as guidance to-day. Responsible men who write or telegraph home asking for their remuneration to be put on a basis more appropriate to present-day conditions have their requests ignored or pooh-poohed, and after irritating periods of waiting the applicant succumbs to the generous advances of Americans who find the man of experience to be just the one they want, and for whom they are prepared to pay well. It is stated to be quite noticeable that the changes referred to are not occurring in connection with *local* British firms, because as their principals or directors are on the spot they are acquainted with the circumstances and act accordingly, so as to retain the men who are so essential to them now that trade is beginning to move again. British manufacturers who read these observations will be in a position to know how far the criticism relates to the engineering profession and trade, and we hope that they will avoid placing this additional handicap upon British trade at a time when a weakening of the personnel may dangerously imperil the chances of industrial prosperity at home.

At a time when trade is so much more generally recognised as being of vital importance to the life of the whole nation, and when men in the works, and technical officials, are securing better recognition of their claims, it is not only unwise, but grossly unfair, that some unorganised men who are essential to success should be so treated that they lose heart, and change over to our competitors, naturally taking with them experience and knowledge which can be used against us. One of our

contemporaries recently championed the cause of clerical workers in engineering offices in London and other commercial centres at home, who had been so hard hit by the increased cost of living, and warned those responsible that unless the lot of these were relieved, they would be lost to other houses who paid better, and the clerical service would be rendered by a lower and less efficient type of man. There are offices that have lost man after man since they were demobilised because some old stuck-in-the-rut "head" of a department, who ought to have been pensioned at double salary in order that efficiency might be increased or economies might be effected, has failed to keep pace in domestic life with the decreasing value of Bradburies and of shillings and pence. So we have discontent in some firms at the very hub of things, and in others among the important officials who run the foreign branches. How can we hope to conduct business harmoniously and successfully, on a large scale and with expedition, if we fail in so essential a matter? The Consul whom we have quoted above mentions one new American firm which started operations in Sao Paulo a short time ago, and called for 15 clerks, "mostly British, if possible." To this new firm three men went from one British firm straightway! Their services were, of course, worth paying for, because they had been in British trade employ. Electrical men will hardly require to be reminded how effective German competition was against us years ago, partly because they used this self-same weapon against us. Ask the men amongst us to-day who were on the staffs of Teutonic or semi-Teutonic electrical and other concerns building up their British trade either in this country or in our Colonies, how they were treated. During the past five years a number of them have told us personally that they had no complaint whatever to make regarding either salary or general treatment; indeed, they declared that they were far better off than if they had been with British firms. We need to bear this practice of our foreign competitors well in mind. We may be pretty sure that no commercial weapon that has been used with success against us in the past, and against which no State or organised protection is applicable, will be allowed to lie idle. A week or two ago we mentioned ways in which British merchant houses abroad had lately been driven into the arms of Continental electrical manufacturers, and were now pledged to use their British names and influence in securing business for Continental works. It is extremely distasteful to us to have to recite such examples of short-sightedness, whether they come directly under our notice, or whether they are received through the medium of an Acting British Consul, but we should be neglecting our duty if we did not set forth the actual facts, so that the broken places in the wall might be repaired.

Boiler-House Practice.

We often pointed out in peace time that in no department of electricity supply was there greater scope for economy than in the boiler house; the importance of this fact is immensely increased to-day, when coal costs about three times the pre-war price and contains far less energy per ton, so that, in fact, we are paying nearly four times as much for the same calorific value. When we allow for the additional cost of handling the increased bulk, and of removing the ash, which is more than doubled in quantity for the same output of electrical energy, we may say that the total fuel costs for a given output are fully quadrupled. Most power-station engineers are, no doubt, painfully alive to the fact, the influence of which on their revenue returns constantly obtrudes itself upon their perceptions; but do they all fully appreciate the logical inference to be drawn from it, and are they all doing their utmost to reduce their coal consumption to the last ounce? Never before did the cost of coal so nearly justify the title of "black diamonds."

There are many measuring devices which have been proved to be of the greatest value in effecting economies of fuel, such as CO_2 recorders, water recorders, weighing machines, calorimeters, and pyrometers, &c.; but while innumerable instruments may be installed in boiler-houses, they are useless unless they are kept in order, and give reliable readings, unless their indications are systematically recorded, and unless the records are analysed with intelligence and insight. All these conditions must be simultaneously fulfilled; otherwise the records may not only be useless as aids to economy, but actually mischievous and misleading. We venture to exhort our power-station readers to ask themselves whether they can individually vouch for the fulfilment of all the conditions to which we have referred, in their own boiler-houses, and whether there are any additional aids to economy of which they have not yet availed themselves. Are the CO_2 recorders in regular and efficient operation? Are the indications of the water recorders reliable? Is all the coal weighed accurately, not only on receipt, but into the stoker hoppers? Is the coal of the highest calorific value available within the bounds of the Coal Controller's regulations—which, by the way, have now been relaxed?

Some time ago we pointed out that there was hardly a power station in Ireland which was properly equipped with efficient weighing apparatus to check the weight of the coal delivered, let alone the coal consumed per shift; and we have reason to believe that almost the same thing could be said of the stations in the Metropolitan area—with some brilliant exceptions. Surely the omission to secure an accurate knowledge of the gross and detail consumption of coal is a fundamental error of the first magnitude. Scientific method in every walk of life is founded upon the basis of accurate measurement, and without this foundation we are thrown back upon the discredited "rule-of-thumb." In order to know how and where to effect an economy it is first necessary to know where waste is going on, and that can only be done by measurement and brain-power.

Surprising results can be achieved if the matter is handled on scientific lines, and that with no great effort, once the necessary data are available. The simple graphic method of analysis developed by Mr. R. H. Parsons, which was described in our issue of February 21st, 1919, enables the station engineer to keep a constant check upon the efficient use of fuel, whilst affording him the means of forming a mental picture of the working of his plant from the economical point of view, such as cannot possibly be obtained by the most minute study of log-book details. No engineer need be told the immense difference between a table of data and the same data embodied in a diagram; and we submit that no engineer who prides himself upon the conduct of his undertaking can afford to dispense with this invaluable key to the secrets locked up—out of sight—in the columns of the log-book. In several instances of which we are aware, remarkable and unexpected economies have resulted immediately from its use.

American Coal for Ireland.

Further particulars of the offer of five big American companies to send coal to Ireland, so as to leave her independent of the "bloody Saxons" and their strikes and squabbles, show that the quotations work out at something like £1 9s. 6d. per English ton, or £1 6s. 6d. per 2,000 lb., which is the American equivalent for our ton, plus the trans-Atlantic freight, in an order for at least 10,000 tons. The firms are situated in New York, Chicago, Boston, and Philadelphia. In another case best bituminous coal is quoted at $5 free on board on the other side, and $5 50 cents for lump coal.

Needless to say, the prospect of getting cheaper and more plentiful coal in Dublin—the industries of which are likely to be otherwise handicapped by limited light and power in the coming winter months—has given rise to much discussion. Coal is both dear and scarce in Dublin, and the much-talked-of Irish mines have done comparatively little, so far, to relieve the situation. It is a poor commentary on the energy of the Government, and on the want of energy on the part of the Irish people themselves, that there is a prospect of Ireland's capital burning American coals—transported well-nigh 3,000 miles—when there are millions of tons within easy reach. The latest available figures show that

in 1916 only 89,983 tons of coal were raised in Ireland, or about one week's supply, Ireland requiring about 4,750,000 tons annually. Unless conditions at home improve, we may yet witness the landing of foreign coal at Cardiff, and even Newcastle—surely the height of absurdity, towards which high wages and low output are driving us.

Electrical Trade in Canada.

Although British manufacturers are in general fully occupied in carrying out orders for home consumption, it is of vital importance for their future prosperity that they make a strong effort to secure their trade connections overseas. In Canada, and in other parts of the world, the inability of our makers to take orders during the last five years has seriously loosened their hold on the markets, and their former agents have been compelled to seek other sources of supply. The alert United States manufacturer was thus given an unrivalled opportunity of enlarging and securing his foothold on Canadian trade. This situation we now have to face, and we feel strongly that our firms should reserve a certain proportion of their output for export, not only to help our falling exchange, but also to retain such trade connection as it may be possible to hold. Elsewhere in this issue will be found an article dealing with Canadian trade, and we commend to our readers the advice therein given. The author of the article writes from the standpoint of an engineer long resident in the Dominion, and well acquainted with conditions there. Every consideration connected with the furtherance of trade in another country could not be published without incurring the risk of assisting our competitors in that market, but such information as we have at our disposal will be gladly furnished to any *bonâ-fide* British concern.

The B.A. Meeting.

After several years' enforced inactivity—so far as public meetings are concerned—the British Association for the Advancement of Science opens its first post-war congress on Tuesday next. Bournemouth receives its baptism of science and remains under its influence until the following Saturday. The Association is fortunate in having Sir Charles Parsons as its president at a meeting which will necessarily derive much of its special interest from the triumphs of science during the past five years in defeating the foul devices and the ingenuity and skill of the enemies of the Allies. The programme of subjects, so far as it has been divulged, promises a very full and profitable five days. The Engineering and Mathematical and Physical Science Sections will produce many papers and some important discussions. The achievements in wireless telephony and telegraphy up-to-date and the electrification of seed will be prominent among these subjects. In the Economic Science Section, after all the controversy and strife of these troubled years, the problems of industrial relationships will probably predominate, though doubtless the financial position and economic policy of the nation will also come in for a large share of attention. Members are fortunate this year in the concentration of the whole of the sectional proceedings in one building. There will be no need to dodge about the town in order to hear papers or discussions in which one is particularly interested—as has generally been the case elsewhere in years past.

Advice to British Travellers Abroad.

British industrial directors, principals, and travellers who are proceeding on visits to colonial and foreign countries with a view to establishing branches, appointing agents, or seeking actual orders would be well advised if they set out with the determination of availing themselves to the full of the facilities that the Overseas Trade Department has prepared abroad for their assistance. In the past, traders have criticised consular, commercial attaché, and Trade Commissioner services somewhat freely. Sometimes their criticism has been based upon unfortunate experience; sometimes upon prejudice imparted to them by others. The facilities have been neglected because the commercial man had lost confidence in all Government assistance of such a kind, owing to the widespread conviction that the inherent defects in the system meant that time set apart for consultation with officials would yield so little practical result that it would be time thrown away. When the four principal Trade Commissionerships were set up they inherited the effects of others' reputation, and had to justify their existence before they were believed in. We heard these Commissioners claim, as they recognised that traders failed to consult them as much as they might have done, that they were prevented by apathy on the part of those whom they desired to help from showing how substantial was the assistance that they were, under the better conditions of their service, able to render. Our national Trade Organisation measures have advanced somewhat since then, and to-day there is no reason for traders' representatives to neglect the facilities that are at their command. It is stated that recently representatives of 11 United Kingdom firms have been in Madrid, and not one of them has made a point of meeting H.M. Commercial Secretary there (Mr. H. M. Villiers, M.V.O.), or has even notified him that he was there. It is not surprising, therefore, to read the following notice in the current issue of the *Board of Trade Journal*:—

> Representatives of British firms, when visiting foreign markets, should avail themselves of the services of His Majesty's Commercial Secretaries. The Department of Overseas Trade desires to call attention to the fact that these officers have been appointed to render as much assistance as possible to British commercial agents abroad, but the opportunity of doing so is often lost through the failure of the latter to call upon them, or even to acquaint them of their presence. . . .
>
> It is suggested that even when commercial representatives do not require assistance, useful information might be placed at their disposal, if they would only get into touch with the Department's overseas representative in the locality.

It is useless clamouring for more Government assistance in foreign markets if we are not willing to go to the trouble of availing ourselves of the services already in existence. We are not back in pre-war days, and the least we can do is to put the present officials *to the test*.

Scientific and Industrial Research.

The Report of the Committee of the Privy Council for Scientific and Industrial Research, together with that of the Advisory Council, of which abstracts appear elsewhere in this issue, is a document of increasing interest and importance. The Research Department is now firmly established, and is progressing on lines which give every promise of a career of usefulness to the industrial community, because they are not the rigid lines of officialdom, but the elastic lines of reason and common sense. It was amusing to observe, in Sir Frank Heath's paper before the Society of Arts in February last, the air of pleased surprise with which he regarded what he described as "an experiment such as no country had ever attempted"—the encouragement of pure research, and the organisation of applied research—the result of which had been "most interesting." Sir Frank Heath explained that the Government had adopted the policy of "delegation to persons specially qualified by their knowledge and experience to do the work in hand, with great freedom to initiate and carry out a scheme of work which they themselves have devised," and he metaphorically lifted up his hands in astonishment and admiration at the successful outcome of this new policy. He remarked that, taken singly, the expert might be "a very embarrassing, and even dangerous, being," but he was far less dangerous when he worked with other experts of his own kind. In these remarks the ingrained distrust of the scientific and technical expert by the classically-educated Civil Servant is clearly visible; but the point is that the experiment embarked upon with doubt and misgiving proved highly successful.

In point of fact, the truly scientific man is as able an administrator as the Oxford man, and in some respects is better qualified to conduct an important undertaking; his adaptability has been abundantly demonstrated—often to his own surprise—during the war. He has vindicated his right to a due share in administrative duties, and eventually, we hope, he will secure it.

TRACK WELDING BY THE METALLIC ARC.

By CYRIL J. HOPKINS, A.M.I.E.E.

For some years electric welding has been employed on the tracks of the Sheffield Corporation Tramways. The earlier work was accomplished with a carbon arc by fusing a metal rod into the required places around the joints of the rails. At the present time this joint welding is carried out by the use of covered metal electrodes, a description of which is given below.

Arrangement of Apparatus.—The welding current is obtained from a motor-generator installed with its switchboard on a covered wagon, and takes its supply from the trolley wire in the usual way. The generator voltage is 70—75 volts. The positive terminal of the generator is connected by some 100 yards of flexible and lightly-insulated cable, wound on a drum and contained in the motor-generator wagon, to the metal electrode through a readily adjustable grid resistance and portable ammeter placed near the operator. This cable is unrolled to the desired length and laid upon the street, the voltage being sufficiently low to prevent any danger to persons or horses, or trouble from short circuits. The negative terminal of the generator is connected to the track rail.

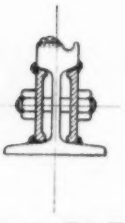


Fig. 1.—End View through Joint Showing Sections of Welds.

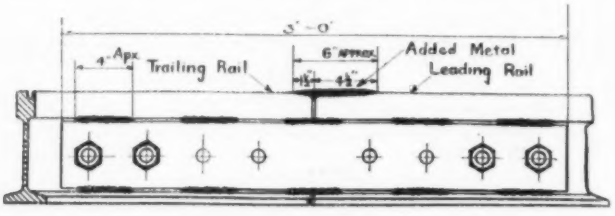


Fig. 2.—Side View of Tramway Rail Joint Showing Arrangement of Welds.

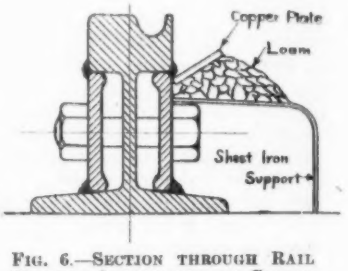


Fig. 6.—Section through Rail Showing Arrangement of Copper Plate for Welding Upper Edge of Fish-Plate.

Nature of Work.—Figs. 1 and 2 give end and side views respectively of a repaired rail joint before grinding, with fish-plates welded to the rail in five places along their upper edges and five places along their lower edges. These fish-plates have a length of 3 ft., and the length of each of the five welds is about 4 in.; with two fish-plates per joint as usual, there are 20 4-in. welds to make.

These each require about one electrode of covered mild steel, so that 20 electrodes, each 1½ ft. long, No. 4 S.W.G., are required per joint. For rails such as these which are being repaired and have not been previously welded together at the ends, a certain amount of wear takes place on the surface, due to the hammering by the wheels. This wear can be compensated for by fusing metal on to the rail surface, as shown in the side view, fig. 2. The added metal is finally ground down to an approximately level surface by a motor grinder, and finished off by a weighted sliding file operated by two men. The method of determining the wear on the rail surface is shown in fig. 3, in which a steel straight edge is placed along the surface of the rail over the joint, and marks are made for the length of surface over which the wear has occurred, so that a metal arc may be played over the surface upon which more metal is required.

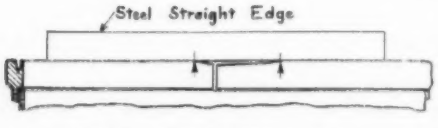


Fig. 3.—Showing Method of Marking Off Limits of Rail Surface Wear.

Fig. 4.—View of Rail Joint Showing Extent of Butt Welding on Rail Head.

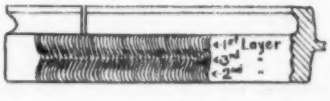


Fig. 5.—View of Built-up Rail Surface Showing Arrangement of Layers of Added Metal.

Details of Rail-surface Welding.—Before the surface is built up, the joint in the rail-head is veed out somewhat by using an electric arc with higher current than is used for building up—namely, 200-250 amperes. This veeing out of the rail-heads, which butt together with rather less than ⅛ in. space between them, is carried out to a depth of not more than ½ in., and then the groove thus made is filled up with metal to the proper level, as shown in fig. 4. After this, two parallel layers of steel are fused on to the surface of the rail over the place required to be built up, and a third layer is added to overlap the junction of these parallel layers, as shown in fig. 5.

Before striking the arc the rail surface is peppered with a chemical preparation to compensate for the material in the rail which the arc would otherwise burn out, so that the hardness of the rail is maintained. This chemical preparation is made to adhere to the surface of the rail by first smearing the latter with oil, so that the approaching arc does not blow it away.

The wear on the rails has a maximum depth of about ⅛ in. over a 6-in. length, of which 4½ in. is on the leading and 1½ in. on the trailing rail (see fig. 2). For building up the surface of the rail a covered No. 6 carbon-steel electrode is used. About six of these are required per rail joint.

Details of Fish-Plate Welding.—In order to make the side welds more conveniently along the upper edges of the fish-plates, ¼-in. copper plates are supported, as shown in fig. 6, just below the seam to be welded, in order to hold the fusing metal more easily in position. These bars of copper are placed on a sheet-iron support, covered with loam and lodged on the fish-plate bolts. Two layers of fused electrodes are added to the upper and lower edges of the fish-plate, and as the flux from the electrodes is less viscous than the fused metal, the former runs, to a large extent, to the low point at the place under the influence of the arc, so that no chipping off of the slag from the upper surface of the weld is done before adding the second layer. This remark applies to the work on both the upper and lower edges of the fish-plate.

The operator, before passing the work on his fish-plate seams, chips them slightly, in order to see that the work below the slag is satisfactory. Should he find a few spots insufficiently built up, he then adds more metal as required.

Chipping Work.—In this work no special cleaning is carried out before commencing welding beyond applying a wire brush to the rusted edges of the fishplates.

The only chipping work of importance, that is to say, upon which an appreciable amount of time has to be spent, is that between the first two layers on the surface of the

rail ends before overlapping the third layer already referred to, and shown in fig. 5. This reduction of the chipping to a comparatively small amount is of great importance, as in some cases the time required to remove the slag produced when using flux-covered electrodes, is equal to, or greater than, the time required for the actual application of the arc itself.

The Act of Welding.—In order to provide convenience for the steadiness of the operator, and thus enable him to maintain with a greater degree of ease the arc length required, namely, $\frac{1}{8}$ in. at the end of a rod protruding 1 to 2 ft. from his hand, a stool about 8 in. high is provided, and the operator places his left foot in the excavated hole around the joint, and adjusts his right leg so as to support his right elbow, and controls the electrode by a wrist movement only.

Result of Electrically Welding Joints.—Before applying electric welding to the joints here referred to, the rails had been connected by two copper bonds. Only one of these copper bonds is retained after welding, more as an assurance against possible defects than as a necessity.

Welding the fish-plates solid with the rail ends has the effect of causing the tramcars to run smoothly over the metals as though they were composed of continuous rails. The usual hammer blow of the pairs of wheels with their accompanying sound "lump-lump," is most pleasantly absent. This is a great advantage, not only to the passengers and pedestrians, but also reduces fractures and wear of the tramcar parts by the avoidance of jolting.

Efficiency of Power Supply.—The following readings were taken from the instruments on the motor-generator wagon :—

Running Light.

Motor	9 amperes	×	530 volts
Generator	0 „	×	70 „

One Operator.

Motor	32 amperes	×	500 volts
Generator	160 „	×	75 „

Two Operators.

Motor	64 amperes	×	480 volts
Generator	320 „	×	72 „

Hence the no-load power consumed by the motor-generator is about 5 kw. at the trolley-wire feeding point, and the over-all efficiency of the motor-generator 75 per cent. with one or two operators. The line efficiency, depending to a large extent on the number of cars running, is about 90 per cent.

Current Consumption.—For the building-up of the rail surface an average of about 150 amperes is used with the No. 6 electrode specified. The current is on about two minutes per electrode, or a total of 12 minutes for the surface work on the rail joint.

For welding the fish-plates the current is on about 10 minutes for each line of five welds, so that a total of 40 minutes is required with current on for two fish-plates. The average current for this work is about 200 amperes, with No. 4 mild-steel electrode. Two operators work with one motor-generator, and each operator can weld four joints per day, allowing for traffic interruptions with a 10-minutes' service. Hence, considering efficiencies and power for motor-generator running light during part of the day, about 20 kw.-hours are required per joint, which allows for loss in the trolley wires up to the feeding point. This energy would cost, at 1½d. per kw.-hour, 2s. 6d. per joint.

Cost of Electrodes.—Number of 18-in. electrodes required per joint is 6, No. 6 carbon steel, and 20 No. 4 mild steel. These would cost, at present prices, about 6s. 6d., but the cost would depend very much upon whose manufacture they were.

Labour Cost.—In a week of 5½ fine days, 22 welded joints can be made; allowing for bad weather, an average of about 15 such joints only would be completed in this time. Assuming a wage of £3 per week, this would give 4s. per joint as the labour cost, excluding grinding.

Motor-generator Costs.—The first cost of a motor-generator of this type—*i.e.*, with a capacity for two operators working with a 75-volt supply—would be about £600, including cost of wagon. The depreciation and maintenance, as well as the supply of tools, cable, &c., would be about £3 per week, or 2s. per welded joint.

Summary of Cost per Joint.

	s.	d.
Electrodes	6	6
Labour	4	0
Electrical energy	2	6
Motor-generator and supplies	2	0
Total	15	0

The writer thanks Mr. Hadfield, the city surveyor, and his assistant, Mr. Kellett, for facilitating his inspection of this work.

ELECTRICITY AND KINEMATOGRAPHY.

By G. E. MOORE.

At the present day electricity is so closely linked with kinematography that it would be difficult to imagine moving pictures without its most varied aid. For example, the high intrinsic brilliancy of the electric arc has made possible the enormous magnification from the tiny photographs on the film to the great pictures on the screen, and gives results which all other forms of illuminant fail to provide. The last decade has witnessed an immense and parallel growth in both kinematography and electricity; the dependence of the former on the latter is not without significance. In this article we will briefly indicate the many ways in which kinematography is co-partnered by electricity.

Let us deal with the two chief stages in the evolution of a film as we know it—production and projection. Scenes in the production of a film may be "shot" indoors (in a specially-erected studio or even in a building) and out of doors. For the majority of scenes, daylight is the illuminant employed, but in dull weather electricity takes the place of the sun. In such night scenes as include a lighted motor-car or house-front, or storm scenes which call for lightning effects, the use of half-watt lamps and the electric arc provides some beautiful and remarkable results. It is during indoor-production work, however, that electrical illumination is so much in evidence.

Every film studio is provided with an auxiliary lighting outfit which can be utilised when natural light fails—and this is a contingency which, as may be readily imagined, is by no means rare in our uncertain climate. Electricity is generated on the spot, or, when the heavy load can be catered for, from local supply mains. Both enclosed arc-lamps and banks of mercury-vapour tubes are favoured for general studio lighting. As the illumination must reach a high degree, a large number of lamps (entailing, maybe, a current of 150 amperes or over) must be used. Owing to the gentle and diffused character of its light, and to its comparative lack of heat, the mercury-vapour lamp has much to recommend its use in the film studio. The appearance of the latter when the overwhelming number of Hg-vapour tubes is erected and running is somewhat startling, and while the sight might delight the "scientific" devotee of electrical illumination, it would probably rouse the ire of his more "artistic" brother.

Extremely beautiful scenes entailing the use of localised lighting are sometimes arranged. One of the most familiar and effective is that of a table, around which one or more persons are gathered. Illumination is from overhead, the remainder of the scene being in obscurity, or total darkness. Another pretty scene of this type is the fireside

setting. Sometimes in an indoor night scene total darkness is observed, any particular object being picked out by a "spot light." And in similarly dark scenes lightning effects through a window produce realistic results. For all these and like "stunts" in studio-craft the electric arc is invaluable.

An interesting departure from the ordinary film-studio is in the use of a large house, the rooms of which may, or may not, demand artificial lighting, and which have many obvious advantages over scenic makeshifts.

The utility of electricity in the studio is not confined to illumination. Another of its uses is in the motor often actuating the kinematograph camera. For normal subjects a definite camera-speed is imperative, and electric drive makes this possible; it also leaves the photographer with much more liberty for focusing, and any necessary movement of the whole camera.

During the process subsequent to exposure, electricity again plays its part, and as the film is now handled in more or less open fashion, the advantages peculiar to electricity as a safe lighting and heating agent are much in evidence. In the dark-room, for example, red lamps of the box pattern may be entirely sealed without regard to fire or ventilation precautions; or carbon-filament lamps with bulbs of ruby glass can be utilised. "Safelight" electric torches are invaluable for inspection of the film during its development. Fans, too, are by no means out of place in hot weather—dark-rooms become very sultry. It is interesting to note that in some instances the film is actually kept in motion whilst immersed in the developing, fixing, and hardening solutions—the motive power being supplied by a small electric motor.

After washing, the film is wound upon large drums, which are then rotated by an electric motor, until the film is dry. Drying is often expedited by electric radiators, the use of which for this purpose is invaluable; they perform their task in a quick, and, from every point of view, safe and reliable manner.

The film with which we have so far been concerned is the negative. From it a number of positive copies must be printed, and for this purpose a printing machine is employed. The negative, together with the film which is to receive the positive images, is passed through the printer (which is actuated by a small electric motor having a field regulator), and exposed to the light of a focus-type lamp. The position of the latter relative to the film may be varied, and its actual brilliancy controlled by a series rheostat. As an adjunct to the printer there is sometimes fitted an electric warning device, which rings a bell should a change in the light density of the film occur, when the position or power of the printing lamp must be altered accordingly.

Having passed through the printer, the positive film goes to the dark-room for development, &c., and after washing and drying, is ready for "screening." The production stage of the film may now be said to have concluded, and, neglecting its travels during the interval, let us proceed straight to the kinema theatre and examine the part played by electricity during the second stage of the film—viz., projection.

It is here that the unique advantage of electricity over any other illuminant, for this particular purpose at any rate, may be realised. The form and illuminative strength of the electric arc render it almost ideal for kinematographic projection. It will be difficult to displace. The one serious disadvantage entailed by its use is the immense amount of heat developed and concentrated on the film. (Operators have been known to inveigh bitterly against the tropical nature of their work!)

The type of arc lamp invariably used in the kinematograph projector is of the hand-feed pattern—the automatic arc has never justified itself. A large number of movement controls are fitted, including, in the direct-current lamp, front and side adjustments for the positive (top) carbon. The arc lamp is, and must necessarily be, extremely robust electrically and mechanically. The majority of projector arcs are run with a current in the region of 40-50 amperes, but in some cases the current may be as low as 20 amperes or as high as 80 amperes. The size of the screened picture chiefly determines the current required, but the length of "throw" also influences it—particularly when the atmosphere is murky with fog or tobacco smoke. Certain makes of carbon are very efficient as regards current consumption; and in many operating boxes an economy is effected by the use of special adapters for carbon stumps, which otherwise would be thrown away.

The operating box is lit by one or more incandescent lamps, and most projector mechanisms are actuated by electric motors of about $\frac{1}{8}$ H.P. In the operating box is situated the switchgear controlling the arc lamp and motor circuits; also controls for the generator (if any) and the auditorium lights—often with dimming apparatus. In the case of two projectors a special change-over rheostat is often installed; this makes it possible to dissolve the conclusion of one part of a film into the succeeding part. The switches for the hall lights are of the two-way pattern, the companion switches (and, possibly, "intermediate" ones) being situated in the auditorium, thus guarding against the results of a breakdown in the operating box. Telephonic communication with the manager's office is often adopted.

The source of energy is either an engine-driven generator or the local supply mains, generally the latter when they exist. As a rule, electricity is rarely generated on the premises when there is a possibility of obtaining it elsewhere. When, however, this is impossible—say, in small towns and the like where no generating station exists—direct current is produced on the spot by gas, petrol, or oil-driven plant. A feature of the Great War was the large number of kinemas which sprang up at the Front and at the bases—in some cases deriving their electricity from a local M.T. or R.E. Company, but generally possessing their own generating plant.

Provided there is local electric supply, then, the price per unit not prohibitive and no objection raised to the load, this is invariably the source of energy. Unless the pressure is low, some means of transformation down to about 60 volts is necessary; otherwise the consumption of energy is excessive, owing to the heavy current required. If at all possible the arc is run with direct current—this may be said to be the rule. Motor-generators or rotary converters are utilised, and static or auto-transformers when A.C. arcs are used. Generally a stand-by arrangement in the shape of a D.P. change-over switch and a suitable rheostat is provided; in the event of a breakdown in the transformer plant, direct connection to the supply mains can be obtained, and the "show" continued without undue delay.

As current is available, the kinema auditorium is electrically lighted. Apart from the ordinary lighting or exterior illumination of a theatre, the kinema may be said to be unique, on account of the full advantage taken of artistic lighting schemes. Diffused and indirect systems of illumination are adopted; many delightful effects are to be seen in our up-to-date picture theatres. Patrons are guided to their seats by attendants' electric torches, and by concealed lamps which illuminate the floor. There are now indicators which signal the vacant seats. In addition, elaborate ventilation schemes are carried out, necessitating the use of electric fans, ozonisers, air-cleaners and coolers. High-class kinemas provide electric lifts, by means of which one ascends to a café where electrically-cooked meals may be obtained.

Stress has been laid upon the fact that the electric arc has shown itself to be invincible. So, indeed, it has, and it still remains the only suitable illuminant for the high-power projection outfit. But in small projectors the half-watt, and especially the "Pointolite" lamps, are being used to a large extent, and ousting the small arc lamp and other illuminants. These lamps have obvious advantages, particularly when their comparative cheapness and simplicity are considered. When these types of lamp are further developed and much higher candle power attained, the large arc lamp will meet with serious rivals and probably be displaced. And this, incidentally, will make the position of the kinema operator less onerous, and possibly affect his status as a skilled man.

A few years ago a most interesting and useful "home projector" (the Pathéscope) was placed upon the market. The original feature in this projector was the arrangement whereby the crank handle not only actuated the film mechanism but also the small generator which lit the projection lamp. This apparatus had a certain vogue in Y.M.C.A.'s

and the like during the war. Another novel projector was described in these columns a short time ago. This machine, which is portable, is driven by a small motor—a half-watt lamp acting as illuminant; connection is made to the nearest lampholder or other fitting.*

There are several minor examples in the shape of perforators, winders, film-cleaning machines, and so forth, which demonstrate the convenience and reliability of the small electric motor. Kinematography as a science and an industry is constantly progressing. From time to time more or less useful "gadgets" (some of an electrical nature) make their appearance. One recent example of interest and utility is a patented focusing attachment for the objective lens of the projector; the attachment can be controlled from any chosen part of the auditorium, and any errors in the operator's focusing corrected.

Mention has been made of the kinema operator, whose business is to operate the one or more projectors under his care. A considerable amount of discussion has taken place concerning his status. Electricity, as has been shown, plays a large part in the actual screening of films, but, regrettably enough, operators' knowledge of electricity is, in many cases, either of a most elementary nature or non-existent. A small proportion of *bonâ fide* electricians may be found in the ranks of kinema operators—mainly where engine-driven dynamos are installed; the work of an operator, however, is hardly of such scope as appeals to the average electrician. Although the electrical portion of a kinematograph projection outfit is by no means of a complicated nature, it would seem that some care, at least, should be taken that an operator is aware of the fundamentals of, and has had experience of, electrical work.

The position is complicated by the fact that during the war there was a great rush of mediocrities into the vacated operating boxes, and also by the fact that with constantly improving kinematographic apparatus, projection work tends to become of a less skilled nature. One awaits with interest the outcome of operators coming under the wing of the E.T.U.

Reference to the operator brings us to one point upon which, in conclusion, we wish to dwell. It has been shown how in projection electricity performs important and intimate functions; its utility during the earlier stage of a film has also been dealt with. The varied applications of electricity in kinematography, therefore, serve to prove its all-round advantages, especially as regards lighting and motive power. But these merits are, we think, no more important than the fact that the different operations are simply and effectively carried out with a minimum or negligible amount of skilled attendance—in some cases under adverse conditions in this respect. From every point of view, therefore, kinematography is an outstanding example of effectual electrical co-operation.

ELECTRIC SOLDERING IRONS.

By C. TURNBULL, M.I.E.E.

For some years past I have been endeavouring to purchase an efficient electric soldering iron, but so far without success. Technically the problem is not difficult to solve; the difficulty is to get makers to amend their designs to meet the circumstances. One iron, which I tried at first, had the element interleaved in slots in the copper bit. The idea of this is quite good, but repairs on the spot are impracticable, and the iron has to go back to the makers every time a repair is needed. This means immense loss of time, and much unnecessary expense. This iron was soon given up.

Some makers sell an iron which is shown diagrammatically in the sketch. The heating coil is wound over a stalk, on to which the bit is screwed. This looks quite good until one comes to use it. Then the fun begins. Owing to the design, all the heat generated in the stalk has to flow through the screw thread into the copper bit. Now the actual surface touching in a screw thread is much smaller than one might at first expect, and the heat density is very high across the contact. This brings about uneven expansion, as the stalk becomes much hotter than the bit. This causes distortion of the parts, and eventually the bit becomes slack on its thread. The flow of heat across the surface is now so impeded that the stalk acquires a very high temperature, while the bit ceases to heat up, and there is difficulty in getting the solder to melt properly. Soon after this the element burns out, and the renewal costs anything up to 15s. The new element is still unable to send its heat into the bit, and it soon breaks down, when there is another bill for repairs.

After long correspondence I have failed to convince the makers that the only way to make the iron work properly is to make the bit and stalk in one piece. The stalk should

Fig. 1.—Diagram Showing Head Screwed on to Stalk.

Fig. 2.—Diagram Showing Soldering Iron with Head Solid with Stalk.

then screw into the end "E" on the diagram. In case of repair it could be taken out, and a new one put in, in a few minutes. In the correspondence the makers first suggested that the electric soldering irons should not be used for long hours. The fact is, however, that it is just here where electric soldering irons find greatest utility. Then they sent a new design which was to put everything right, but the bit was still screwed on to the stalk, so that the trouble was bound to recur. Finally, they offered to send on an iron which used less current. Of course this might solve the difficulty in one direction, but the iron would not have enough heat to do its work properly.

There is an opening for a good iron, and as there seems to be no difficulty in making one which will do its work well, and which can be repaired on the spot at small cost, cannot some British maker supply the want? Why should we have to wait until the foreigner places the right thing on the market?

* Elec. Rev., August 1st, 1919, page 158.

Non-Ferrous Metals Research Association.—The British Non-Ferrous Metals Research Association is being instituted and organised to act as a medium for securing the fullest possible benefits from scientific and industrial research and information which are essential for the present and future progress of all industries concerned in the production, treatment, manufacture, and use of non-ferrous metals. The Association will have the support of the Government Department of Scientific and Industrial Research which has a special fund set aside for the financial aid of associations such as the one now in process of formation. In a brief survey of the scheme it is stated that the Association will encourage and develop technical efficiency in the production, treatment, and utilisation of non-ferrous metals and alloys, by the promotion and application of scientific and industrial research, and also institute an information bureau of all important technical and scientific information relative to the non-ferrous metals industries of the British Empire. A Provisional Committee is now at work. This Association will use every endeavour to promote research on broad and continuous lines, and so assure progress in the non-ferrous metals industries.

SCIENTIFIC AND INDUSTRIAL RESEARCH.

THE Report of the Committee of the Privy Council for Scientific and Industrial Research for the year 1918-19 has just been issued (Cmd. 320, H.M. Stationery Office, price 6d. net). It comprises 94 pages, including several appendixes, and covers a very wide field.

The Report states that during the year the work of the Department has grown in usefulness and amount; a marked change is taking place in the attitude of industry towards scientific research—both masters and men are beginning to realise its vital importance. The success of the scheme of co-operative Research Associations is now assured. The demand for scientific workers is growing rapidly, not only in the industries, but also in the universities and in Government departments, and something has been done to increase the number available, but it will be years before the enlarged demands can be adequately met; hence all plans for research should be drawn up with a view to making the best use of existing institutions and personnel.

The administration of the Geological Survey is to be transferred to the department as from November 1st next. The Fuel Research Station at East Greenwich is in operation, and one of the largest gas companies in the kingdom is about to seek statutory authority for adopting the procedure recommended by the Director of Fuel Research, which will inaugurate a new era in the relations between gas companies and their customers. The Fuel Research Board will undertake the establishment of a permanent organisation for the study of the problems of Power Alcohol. Improvements and extensions to the buildings and organisation of the National Physical Laboratory have been authorised, including the adoption of a superannuation provision for the staff, and an outlay of £154,650 for the laboratory services has been provided, as compared with £116,038 expended last year. A grant of £10,000 has been made to the Medical Research Committee for the work of the Industrial Fatigue Research Board. The sum standing to the credit of the "million fund" in the books of the Imperial Trust on June 30th last was £1,061,184; the expenditure had been £17,507, and the trustees were committed to the provision of further grants to the eight Research Associations then in existence to the amount of £198,000. Grants that will be made to nine Associations now in course of formation are estimated at £175,000. The ultimate number of Associations is expected to be between 40 and 50.

During the past year seven patents have been taken out by the Trust in conjunction with inventors, and two have been abandoned.

Recommendations for grants to 28 scientific investigations conducted by other bodies have been approved; of these, four were new proposals. Grants were made during 1918-19 to 35 students under training in research, and to 68 other workers, the total expenditure under this head being £14,170.

The total outlay of the Department during the year was £177,201, made up of £163,350 provided by Parliament for the Department, £5,129 from a vote of credit, and £8,722 from the million fund.

Special thanks are accorded to the Directors of Fuel Research and of Food Investigation, and to the chairman of the Tin and Tungsten Research Board, for their gratuitous services.

The Report of the Advisory Council to the Committee laments the death of Lord Rayleigh, whose services were of inestimable value. Discussing the future of the Department, the Report deprecates any attempt to organise research in pure science, but approves of the organisation of industrial research and the establishment of a central body and a central "clearing house" for that purpose. The conduct of research by the State for the benefit of industries which are not under State management is condemned, but assistance to such researches by means of grants-in-aid is approved; the commercial development of the results obtained is said to be no concern of the Department. The organisation of research for national purposes is now seen to be likely to form a much larger part of the work of the Department than was at first expected.

During the year the British Scientific Instrument Research Association has been joined by the bulk of the firms engaged in the electromedical instrument industry and the electrical scientific instrument industry, and the scale of grants has been correspondingly augmented. The Department has guaranteed an additional expenditure of £24,000 to £30,000, on condition that the new members make an immediate contribution of £2,400 to £3,000 out of their net revenue account; the amount previously guaranteed was £40,000, spread over a period of five years. These exceptional terms are due to the fact that the industry falls wholly within the class of "key" industries. Similar considerations apply to the Glass Research Association.

In the engineering group of industries the only Research Association yet established is that of the British Motor and Allied Manufacturers. A Research Association for the makers of refractory materials is about to be launched, a Portland Cement Research Association is at work, and the scheme of the Non-ferrous Metals Research Association has been approved. As the result of the researches into the properties of hard porcelain, arrangements are being made for the establishment of a factory making only hard porcelain. Doubts as to the future of the mining industry have for the present suspended the movement of the Mining Association of Great Britain towards the establishment of a single Research Association for the whole kingdom, and the increased cost of labour has similarly hung up the scheme of the shale oil industry. Up to July 31st, nine associations had been licensed and eight approved.

Revised conditions for the grant of funds to Research Associations, consequent on the signing of the armistice, were drawn up in January last, making it clear that all results of investigations obtained by the associations belonged to the latter for the benefit of their members; the Department, however, reserved the right to secure the communication of results to other industries on reasonable terms of payment, and to prohibit their communication to any person or body under foreign control.

Experience of the working of the scheme of co-operative research has shown that there is a real spirit of unity abroad, and a desire for co-operation, even between buyers and sellers, particularly in the textile industries, in which the markets for raw materials are highly organised.

In planning a scheme of research, which requires a survey of the field by a competent staff under a responsible technical officer, it is generally felt that "a Director of Research should not necessarily be an expert in a particular industry, nor a man who has greatly specialised in a particular branch of science, but a man with a wide knowledge of science, endowed with sympathy and tact, and having a willingness and capacity to learn."

Many new problems have arisen during the evolution of the research movement, for the solution of which the Department has arranged to hold periodical conferences with representatives of the Research Associations and of its own Research Boards and committees. The first of these was held in July last, and is reported on another page; as a result, certain broad considerations have been recorded as a basis for further discussion and inquiry.

Amongst these are the conditions of employment of scientific workers. "The war has made the scientific man realise his vital importance to the community as a means of defence, and a certain class-consciousness has arisen among the younger men, of which account must be taken." The work done in the research laboratories is essentially team work, and suggestions that research workers should be allowed to patent and exploit for their own benefit any discoveries that they make, and which their employers may be unwilling to take up, are deprecated. For the protection of professional consultants, it is recommended that Research Associations should not undertake routine work of the kind hitherto performed by the consultant class. One Association passes such work to a panel of consultants, the firm making the inquiry and the consultant employed remaining unaware of each other's identity. It is believed that original workers amongst consultants will find the demand for their services not diminished but increased, as a result of the establishment of Research Associations.

In some cases matters of common interest will call for the co-operation of two or more Associations, but the mechanism for this purpose has not yet been devised.

Proposals received by the Department for the establishment of a national clearing house for the results of research, or of a technical information bureau, have all been rejected. A more hopeful prospect lies before the provision of means for the systematic review of existing collections of information and its presentation by trained workers in proper perspective. But it is believed that within suitable limits the Department can usefully distribute information relating to work done under its supervision, through a Records Bureau. The work will be commenced on a small scale and gradually developed.

Part II of the Report of the Advisory Council deals with the growing body of work undertaken by the Department for national purposes, and gives an account of the operations of the National Physical Laboratory, and various Research Boards. The scheme promoted by the Institution of Electrical Engineers for the establishment of a British Electrical Proving House was considered by a Committee appointed by the Advisory Council, and as a result of its deliberations the Council reported that the routine testing of ordinary commercial products ought not to be undertaken by the N.P.L. or the Department, though the research necessary to the formulation of suitable tests would fall within its scope. The Government accepted this view, and proposals for State action in respect of the promotion of standardisation, in which the N.P.L. would take the part mentioned above, are under consideration.

The Fuel Research Board has dealt with the questions of Irish peat, pulverised fuel, and gas standards; the Food Investigation Board is carrying out work of great importance in various directions; the Tin and Tungsten Research Board has issued its first report; the Oxygen Research Committee has taken over the researches carried on in war time by other Government departments; and a separate Gas Cylinders Committee has been established; the Committee on lubricants has made good progress and is preparing its final report; the Timber Research Committee has experimented on the seasoning

of timber; important results have been obtained by the Building Materials Research Committee—if only £1 were saved on each of the new houses that are to be erected, the saving would pay for more than the whole of the annual expenses of the Department, apart from the enormous economy in coal consumed by improved kitchen ranges and the value of the increased health of the community—and a Building Research Board is to be established; abrasives and polishing powders, brass and copper castings, and the metallurgy of copper and zinc have been under investigation, and a very extensive inquiry is being carried on by the Industrial Fatigue Research Board. The Secretary of State for the Colonies has appointed a Research Committee to administer a fund of £100,000 provided by the Treasury for the encouragement of research in the Crown Colonies over a period of five years, and the Department is in close touch with the corresponding organisations in Canada, Australia, and India; similar schemes are being developed in New Zealand and South Africa, as well as in several foreign countries.

In Part III of the Report particulars are given of assistance afforded to various independent institutions. The appointment of a Director of Research by the Electrical Research Committee is mentioned, and the hope is expressed that an Electrical Research Association will be formed by the manufacturers. For this reason the Council has agreed to the proposal made by the Institution of Electrical Engineers that the direction of the aided researches into the heating of buried cables and into insulating oils should be entrusted to the committee. Excellent results have been obtained by the Institute of Gas Engineers in a research on refractory materials, with the aid of a grant from the Department. The work done by the Corrosion Committee of the Institute of Metals will greatly lengthen the life of condenser tubes, and the investigations of the British Fire Prevention Committee into the fire-resisting properties of concrete and reinforced concrete have revealed unexpected and important results. The Council deprecates the suggestion that much more liberal grants should be made to scientific and technical societies than to trade associations, on the ground that it would be destructive to the policy of encouraging co-operative research if the duty of undertaking large schemes of industrial research were entrusted to the societies rather than to the industries, but the former will receive grants-in-aid at least as generous as those offered to Research Associations, and in some cases they will be able to conduct researches unsuitable for attack by a Research Association. As research is only spare-time work in the hands of a society, and the secretarial staff is inadequate to administer large sums of public money, the work that scientific societies can undertake is restricted to moderate limits.

Referring to grants to students and research workers, the Report points out that it is incumbent on the professor or other research worker on whose recommendation such grants are awarded to maintain a high standard, if the system in force is to prove successful. The return of peace has rendered necessary a modification of the practice with regard to the publication of the results of research in pure science; results obtained with the aid of public funds should not be exploited for the benefit of an individual firm, but should be made generally available to the industries interested, on reasonable terms, and an adequate reward should be secured to the inventor. These two objects can be attained without, as in war time, requiring that all results should be submitted to the Department before publication, and the Department has decided that unless in the opinion of the Advisory Council the subject of investigation is likely from the outset to lead to results of commercial value, a research worker assisted by a grant from the Department may publish his results as he thinks best, provided that he does not take out a patent or make other commercial use of them without previous consultation with the Department. But where commercially valuable results are anticipated, the previously existing conditions regarding their availability will be maintained. With regard to the expenditure of grants for equipment, &c., attention is drawn to the rules laid down, which enable the scientific man to delegate his responsibility in this matter to his college office or other responsible authority.

Particulars are given of a number of appointments secured by workers aided by the Department during the past year.

During the year 103 grants were made to students and workers and for apparatus, compared with 67 in 1917-18; 13 applications were refused, ten were referred to other departments, and 19 were withdrawn. Of the grants made, 66 were for pure science and 28 for applied science; 72 were new grants, and 31 were renewals. Grants are not as a rule made for the solution of specific problems in connection with an industrial process, unless at least half the cost is borne by some body representing industry, such as a Research Association. A large increase in the number of grants awarded will be possible under peace conditions, while a high standard will be maintained.

Many difficult questions arise in connection with patents, particularly foreign patents, when they are held by Government, and no definite solution has yet been found. No worker under the Department may patent a discovery except with the sanction of the Committee of Council, and when this is given the patent is taken out in the joint names of the inventor and the Imperial Trust. The Department reserves to itself complete discretion in the administration of the patent rights after consultation with the inventor. It has been provisionally decided that patents should not be taken out for: (*a*) inventions of value for the preservation of health or of life, or (*b*) inventions the use of which can be enforced by a Government department. In these cases steps are taken to secure full and complete publication to prevent others from patenting the inventions. But there are objections to this procedure, as in the absence of a patent a manufacturing firm has no incentive to work the invention, especially where the invention needs further development before it can be placed on the market. The question requires further discussion.

Appendixes give the names of members of the various committees and boards of the Department, the names of the Research Associations, particulars of the Government scheme for industrial research, conditions as to payments to Research Associations, a list of researches aided in 1918-19, the text of a manifesto issued by the American Federation of Labour advocating research, and details of the N.P.L. Trust Funds.

Numerous references are given to publications of the Department, of which we may mention "The Government Scheme for Industrial Research" (*Research Association* 1, *revised*), "Draft Memorandum and Articles of Association for Trade Associations for Research" (*Research Association* 2), "Conditions as to the Payment to Research Associations by the Committee of Council" (*Research Association* 3, *revised*), "Method of Subscription to Research Associations" (*Research Association* 4), and "Notes on the Conditions under which Grants are made to Individual Research Workers and Students-in-Training" (H.M. Stationery Office, 2d. net).

CLEANING FURNACE GASES.

Realising the inefficiency of the various methods of cleaning and burning blast-furnace gases, Mr. F. E. Kling, chief mechanical engineer, and Mr. L. B. Weidlein, experimental engineer of the Ohio works of the Carnegie Steel Co., five years ago started experiments to overcome the difficulties. In the course of their experiments, they developed a very efficient gas burner for boilers, which fulfilled the conditions required for burning blast-furnace gas efficiently. After completing this phase of the problem, steps were taken to make a comparison of results obtained from burning gas which had been cleaned or partly cleaned by various means, and dirty gas taken directly from the dust catcher. An impinging type of wet washer was found to be very inefficient, as it reduced the temperature about 50 per cent., was not more than 50 per cent. efficient in removing the dust, and the gas picked up about 15 per cent. additional moisture.

The next experiment was made with gas that had passed through the cleaning plant for gas engines, which included a spray tower, baffle tower, and Theissen washer. This method of cleaning was prohibitive from the standpoint of cost, while the sensible heat of the gas was reduced to such a point that the usual size of combustion chamber was not long enough to obtain complete combustion.

An experiment was then made with hot gas taken directly from the dust catcher, and much better results and efficiencies were obtained than with either of the former experiments, although large quantities of dust had to be contended with, and the dust had to be blown off the boiler tubes frequently. After further experiment, a novel means of removing the dust from the gas was developed, and an experimental cleaner was built, designed to handle 6,000 cu. ft. of gas per minute at 62 deg. F. The gas passing through this experimental cleaner was consumed under a 400-H.P. Stirling boiler, and after a month's operation, without blowing the tubes, there was less than 50 deg. F. increase in temperature of waste gases on account of the dust accumulation. What little dust came through the cleaner was of such a nature that a large portion of it was carried through the boiler and out with the waste gases. The portion deposited on the tubes was easily removed by blowing it with a hand steam lance. The dust carried by gas which has been wet-washed bakes on the tubes and is hard to remove.

This experimental cleaner was inspected by various individuals and committees, and was pronounced a remarkable development, which would revolutionise cleaning methods for blast-furnace gases. Due to the very satisfactory results obtained from the above experiment, the United States Steel Corporation authorised the installation of a cleaner large enough to clean all the gas from one blast furnace. This furnace has a capacity of 550 tons of iron per day, and produces 80,000,000 cu. ft. of gas which passes through the cleaner daily.

The cleaner was constructed of reinforced slag concrete, due to the scarcity of steel plates during the war. The structure was built to withstand an explosion pressure of 15 lb. per sq. in., and it is well equipped with explosion valves of special design, which are set to open at 1 lb. pressure per sq. in. The walls, being 15 in. thick, act as a very good insulator to retain the temperature of the gas. The concrete has shown no deterioration, and has withstood all conditions to which it will be subjected, and no trouble is anticipated.

The operation of the cleaner is entirely automatic, and it does not require constant attendance. One of the men from the regular force maintained in blast-furnace operation inspects and lubricates the machinery once or twice a day.

The power required to operate this cleaner 25 per cent. of the time is 4.25 H.P., and 75 per cent. of the time 2 H.P.,

making an average power required of 2.58 H.P., as compared with 80 H.P. to 100 H.P. for a wet washer. The dust is accumulated in hoppers of sufficient capacity to hold two or three days' accumulation. It is then dumped into standard hopper cars, the operation requiring only about half an hour.

The average amount of dust deposited in this cleaner since starting operations is 63,500 lb. per 24 hours, although the gas has previously passed through a dust catcher 30 ft. in diameter. This represents 48.6 per cent. of the total dust leaving the furnace by way of the downcomers. The cleaner is maintaining a cleaning efficiency of 90 to 97 per cent., the dust content in clean gas being 0.10 to 0.30 grains per cu. ft. at 62 deg. F.

The range of temperature of the gases which have passed through this cleaner is 150 to 800 deg. F., and the average loss in temperature due to radiation is 25 to 35 deg. F., with atmospheric temperatures ranging down to 10 deg. F.

The back pressure on the furnace is only 2 to 3 in. water gauge. This includes all piping to and from the cleaner, and the cleaner itself. This is considerably lower than the resistance through any type of wet washer.

The cost of an installation for cleaning gas by this method compares very favourably with the cost of a complete wet washing outfit; and considerably less ground space is required, due to the absence of settling basins. Several additional installations have been contemplated at various places, including another cleaner to be built at the Ohio works.—J. C. Barrett, in *Chem. and Met. Engineering*.

GLASGOW'S NEW POWER STATION.

On Friday last members of the T.C. Electricity Committee made an official inspection of the new power station at Dalmarnock. The station is being constructed in two sections, but the work has been delayed on account of the war, the operations being entirely suspended at one time. The first portion is nearing completion, and a supply of energy is expected before the end of the year. The original estimates were for two millions sterling—one million for each section—but it is expected that that figure will be very considerably exceeded. In an official description of the buildings and plant visited, it is pointed out that the main thing to be noted in Dalmarnock power station is the size of the individual units of generating plant. They are practically the largest at present available, although larger sizes are likely to be put on the market. The rate of development of electrical machinery in Glasgow is readily shown by the following figures: In 1893 the largest unit was 250 H.P.; in 1903, 1,000 H.P.; in 1913, 9,000 H.P.; and in 1919 the largest unit is 25,000 H.P.

The switch house is a four-storey building in the centre, and measures 108 by 45 by 71 ft. high. On the ground floor there are transformers to be used for raising the pressure from 6,500 to 20,000 volts. Staff accommodation is provided on the first and second floors in the centre block. The third floor is entirely occupied by control cables and wiring in connection with the operation of the station. There is a small battery on this floor. The fourth floor is the switch house proper. The control room measures 50 by 50 by 17 ft. There is a large storage battery situated in the basement of the central block. There are two inlet water ducts from the river Clyde, each measuring 6 by 8 ft. The water is passed through revolving filter screens, and from these flows into one duct measuring 11 ft. wide by 14½ ft. high. The main water culvert runs along the whole length of the south wall of the turbine room. An outlet or return water duct runs along the whole length of the north wall of the turbine room, and is continued under the floor of the coal store to an outlet 330 ft. down the river from the inlet. The turbine room, as at present completed, measures 225 ft. long by 75 ft. wide, but ultimately it will extend to double this length. The plant now installed consists of two condensers, each having 5,500 tubes. The circulating water to each condenser amounts to 22,500 gallons per minute, and is supplied by means of a 36-in. pipe. One turbo-alternator of 18,750 WK. (25,000 H.P.) is almost completed. One turbo-alternator of 500 KW. (660 H.P.) is completed, and will be used for supplying energy to drive the auxiliary plant in connection with the main turbine. A 75-ton travelling crane is fitted.

The building of No. 1 boiler house is completed, and measures 149 ft. long by 80 ft. wide by 73 ft. high. There are two rows of four boilers, or eight boilers in all, each with a steaming capacity of 50,000 lb. per hour, the steam pressure being 275 lb. per sq. in. There is a pump house at the end of each row of boilers in which are installed one electrically-driven and one steam-driven feed pump. On the second floor are housed economisers, induced-draught fans, hotwell tank, and the bases of four chimney stacks. The basement floor contains ash conveying plant and forced draught fans. The workshop measures 225 ft. by 30 ft., and has a 75-ton travelling crane. There is an area for storage of coal, of 630 by 225 ft. This will give storage accommodation for 75,000 tons of coal. A travelling gantry, having a span of 190 ft., on which are fitted a grab and coal conveyor, can operate over the whole area of the coal store.

After the inspection lunch was served in the city chambers. Ex-Bailie Kennedy, the convener of the committee, who presided, referred to Mr. W. W. Lackie, the chief engineer, as a man whose ideal was to keep abreast of electrical science. Mr. Lackie, who spoke briefly, said he believed the works were the largest in the country. The Government's Electricity (Supply) Bill, which proposed to take over the generating stations, had been considerably amended, and he was sure the members of the Glasgow Committee would be loth to give up the works after the time and labour they had expended in constructing them. They would wait and see what Parliament decided to do, but he hoped Glasgow T.C.'s Committee would long continue to provide for the citizens a cheap supply of electricity.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Feeder Protective Gear.

I have read with great interest Mr. Whitcher's notes on the above subject. My own experience of protective gear does not go back further than four years, and although I have been working experimentally with compensated relays of my own design practically all that time, I only recently became aware that the B.T.H. Co. had patented a scheme.

Mr. Whitcher's ideas as patented in 1910-11 cover most of the defects of Merz-Price balanced voltage gear, and are well worthy of being better known.

Charles W. Marshall.

Carluke, *August 27th*, 1919.

Air Supply for Pianola.

Being desirous of using a small motor (which I have for running a generator) to supply air pressure to work an ordinary pianola, now supplied by a foot bellows into an air chest, I should be glad to know whether any of your readers could give me their experience in a similar case. I propose running a belt-driven fan, with a 2-in. tube inlet into the chest, with a hand-operated slide valve on the tube. I should like to know the maximum pressure the pianola requires, being mechanically operated, and a suitable type of fan for the purpose.

D. Spencer.

Acton, *August 25th*, 1919.

Electric Vehicles.

Referring to the article entitled "Electric Vehicles" in your current issue, the author, Mr. Austin, severely criticises station engineers because, forsooth, they apparently have not acted whole-heartedly as salesmen for electric vehicle manufacturers. Seemingly, because Mr. Austin has omitted to study the subject from the station engineers' point of view, he has the effrontery to accuse "men trained as engineers" of the lack of commercial ability, &c. Whatever they may have done in the matter before the war, I am sure that most engineers are now fully occupied in "nursing and cherishing" (as Mr. Austin puts it) their plant under the conditions which prevail, and they have very little time to devote to boosting electric vehicle sales. I can assure Mr. Austin that station engineers are not so ignorant and disinterested as he suggests, and they certainly do not require any advice from him regarding commercial problems of this nature.

Manufacturers have, or should have, agents in various districts, whose business it is to promote sales of the articles they are specifically interested in. As regards electric vehicles, it is obviously the agents' business also to make all necessary inquiries as to charging rates and facilities. Any station engineer who received such inquiries would surely be only too willing to assist the agent in every possible way.

Mr. Austin refers to the problem of charging facilities as being "really very simple," and advocates the charging being done on the vehicle owners' premises. I wonder if he has ever inquired into the present cost of small motor-generator outfits for ordinary business vehicles, and if he has, whether he has found it such a simple matter to persuade vehicle owners to install such outfits? It stands to reason that the purchaser of a *fleet* of electric vehicles *would* install a complete charging outfit as part and parcel of the garage, but it is a very different case when only one vehicle is concerned, and it would take a good deal to persuade a man who had just invested £1,000 or more in a vehicle to incur upwards of £150 additional expense merely for the privilege of being able to charge the vehicle on his own premises instead of sending it to the local generating station.

Mr. Austin mentions that he has given great attention to the subject of electric vehicles; I have no doubt that he has, and he probably knows as much as most people about the uses and many advantages of electric vehicles, but has he ever tried to *sell* one of them? Let Mr. Austin do a six months' tour through small provincial towns as an agent for any well-known make of vehicle; he would probably have reason to be very disappointed with the results of his efforts, so far as his

sales were concerned, but in the course of the tour he would no doubt make the acquaintance of quite a number of station engineers, and thus he would realise that the opinions he now puts forward are not only narrow-minded, so far as they refer to station engineers, but they also indicate complete ignorance on his part of the real facts of the case. All credit to Mr. Ayton and a few others who have worked so hard for the cause of electric vehicles, but let it be remembered that there are many engineers who have also done their best in a quiet way, and some have been successful while others have not. I happen to be one of the latter, but I am persevering in spite of the total absence of any practical assistance on the part of the manufacturers, who, so I am led to understand, are busy with orders already in hand, and cannot promise delivery on any new order in less than eight months.

P. A. Spalding,
Engineer and Manager.

Electricity Works, Dundalk, *August 23rd*, 1919.

Meter Readers' Books.

It would be very interesting to have the experience of some of your readers on the very important question of meter readers' books.

The loose-leaf book has many advantages, as a page can be used for each consumer, and leaves can be added as the consumers are increased.

So far as I have seen the present loose-leaf books are made with heavy backs, and are altogether so bulky that they are difficult to carry. If the weather is wet and the man is carrying the book in his hand, it will get wet, which will not be good for the records.

One method would be to provide the meter reader with a neat waterproof bag slung over his shoulder into which he could drop the book when walking. Alternatively it may be possible to get something of a lighter pattern which could be made up in relatively small books, which the man might put in his pocket.

If those who have tackled the problem would put forward their solutions it would be of interest to everybody.

C. Turnbull.

Electricity Works, North Shields.
August 28th, 1919.

Industrial Relations.

May I be allowed to say how much I appreciate the admirable leaderette in your issue of to-day's date on Industrial Relations. If only the community were animated by the spirit manifested by this article we should hear no more of "Labour unrest" and such like troubles.

It is because I feel that such a state of affairs is urgently required at the present time that I am impelled to write and thank you for doing what you can to bring about "Peace with Honour" in the industrial world, as the expression of such sentiments is bound to help on, if only a little, the cause of true progress.

I wish that your words could be read by all, whether employers or employés—not only read, but thoroughly digested and assimilated, as the body public requires just that kind of food to build it up, strengthen it, and vitalise it for the common good.

Arthur J. Nicholls.

London, S.E., *August 29th*, 1919.

The Manufacture of Rheostats.

I have been interested in reading the letter above the signature of Mr. L. F. Fogarty in the current issue of the Review, and it may be perhaps of interest to you and your readers to know that practically all these forms of rheostats were manufactured by myself and partners some thirty years ago. Not only did we make use of slate, having the resistance wire wound in grooves cut in the edges, but we introduced porcelain sections which could be fitted together to form a rheostat of any length, and which we marketed for many years. If my memory serves me correctly, at that time, thirty years ago, there was no such thing obtainable in this country as a German rheostat of that particular form.

Edward L. Joseph.

London, S.W., *August 29th*, 1919.

With reference to the letter published in your last issue with regard to rheostats, we beg leave to point out that the type of resistance as illustrated under figure 2 has never been manufactured by us, a fact which was well known to the writer of that letter whilst he was in our employment.

We do not really see what he is tilting against, because we have never claimed to be the originators of this type of resistance, which before the war we imported from Messrs. Ruhstrat, being then their sole British agents. What we do claim, however, as you were good enough to point out in your note, is that we recognise the necessity of certain improvements in the original type, and partly during the war, but mostly afterwards, when the imperious duty of quick deliveries had become less pressing, that we very materially improved the type, and firmly established the manufacture of such resistances in this country.

As regards the statement that "superficially oxidised wire and slate resistances having wire wound in grooves cut in the edges have all been introduced by German firms," we might say that this does not appear to be the case. Messrs. Ferranti, Ltd., for instance, employed the notching at the corners of blocks of slate to obtain definite spacing between the wires as far back as some 15 to 20 years.

Isenthal & Co., Ltd.,
A. W. Isenthal, *Director.*

London, N.W.
August 30th, 1919.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Supreme Electric Bell.

The design of this bell is a new departure; in appearance it is of the usual type, and consists essentially of a moulded insulated base and cover giving an insulation resistance of at least 20 megohms, at the same time being both fire, insect, dust, and water proof, and practically unbreakable. The electro-magnet contact plates, gong, and contact pillar, &c., are all moulded in the base and immovable. This feature will be especially appreciated in regard to the contact pillar,

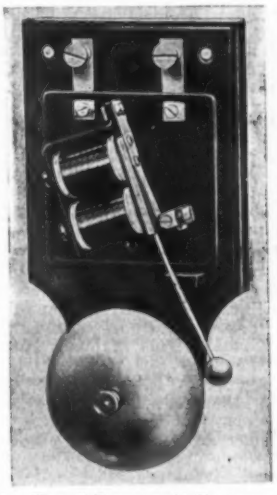


Fig. 1.—The "Supreme" Electric Bell.

which consequently cannot get out of alignment or adjustment under any condition. A fillet is provided all round the base accommodating the cover and rendering the bell weather proof and suitable for outdoor use. The magnet coils are wound with silk- or enamel-covered copper wire to a resistance of 4 to 5 ohms., on varnished hard-wood bobbins, and the soft Swedish iron cores are provided with a thin brass damping piece, avoiding any risk of the armature sticking. Fig. 1 shows the bell, which is manufactured by Messrs. F. J. Shenton & Co., Ltd., 68, Shoe Lane, London, E.C. 4.

Bastian Hot-water Tanks.

The Bastian Electric Co., Ltd., of 135, Wardour Street, W., is about to put on the market a hot-water tank heated by electricity; it is intended to be left in circuit all the time, so that a very low price for the electrical energy should be obtainable, and a meter can be dispensed with. At ¾d. a unit, a tank consuming 300 watts continuously will supply 20 gallons of water daily at 150 deg. F., capable of providing for the needs of a family of ten persons, at a cost for energy of 37.8d. a week. It is claimed for the Bastian tank that it has a higher efficiency than any other continuous hot-water supply system, the water drawn off is always at 150 deg. F., the water is not "stewed" and can therefore be used for tea and cooking generally, and the system saves coal. With a supply of water at 150 deg. F. the utility of ordinary electric cooking apparatus is greatly extended, as the water can be quickly brought up to boiling point.

The White Mazda 50-Watt Lamp.

An important development in incandescent lamp manufacture is the "White Mazda" 50-watt lamp, produced by the National Lamp Works of the General Electric Co., Nela Park, Cleveland, Ohio. The new lamp has a milk-white smooth bulb which gives excellent diffusion of the light over its entire surface. It is of the gas-filled type, being the smallest lamp yet made of this type. It is a tipless lamp. The brightness

of the bulb is about 13 candles per sq. in. over the brightest sq. in. of area, which is, of course, far below that of the filament of a Mazda B lamp. Notwithstanding the low brightness of the bulb, it supplies more light than the 50-watt Mazda B lamp. Because of the softness of its light, the white Mazda lamp can be used satisfactorily in locations where any other incandescent lamp unless frosted would be objectionably bright. The frosted bulb collects dust and dirt more quickly than a clear bulb and is more difficult to clean; the bulb of the white Mazda lamp is smooth, and is as readily cleaned as a clear-glass bulb. The field for the white Mazda lamp lies in the replacement of the smaller sizes of Mazda B lamps in existing reflector equipment. The effect produced by using white Mazda lamps in semi-indirect fixtures is particularly pleasing. There is little difference in the absorption of units tested when equipped respectively with Mazda B and with white Mazda lamps. The lamp has about the same maximum dimensions as the 40 and 50-watt Mazda B lamps. The lamps are made for voltages from 110 to 125; their lumen rating is 490, giving an efficiency of 9.8 lumens per watt.

ELECTRICAL PROGRESS ON THE CONTINENT.

Hydro-electric Works in Czecho-Slovakia.

A great scheme for the utilisation of the water powers in Czecho-Slovakia, which are estimated at 800,000 h.p., has been approved by a Bill which has been adopted by the National Assembly. The installations necessary for laying out all the territory for the use of electricity will require an expenditure of 2,000,000,000 crowns for the hydraulic work, 500,000,000 crowns for the central stations, and 1,000,000,000 crowns for the distribution of electricity. It is calculated that the total revenue from the consumption of energy will reach 1,000,000,000 crowns per annum. According to the law in question, an annual credit of 75,000,000 crowns is to be entered in the Budget estimates for the years 1919 to 1923, and two-thirds of this amount will be devoted to the construction of hydro-electric works, whilst the balance will represent the financial participation of the State in the working of undertakings for the production and distribution of energy. The State, the departments, and the communes will alone or in co-operation with existing electricity companies take up 60 per cent. of the capital so as to secure influence in the undertakings, whilst private capital will only be admitted up to 40 per cent. Part of the capital to be raised will be covered by the issue of bonds and debentures. The sum of 8,000,000 crowns out of the total amount voted by the National Assembly will be placed at the disposal of the undertakings for the current financial year.

The scheme aims at the establishment of nine large electrical undertakings, of which four would be in Bohemia, three in Moravia, one in Silesia, and one in Slovakia. Certain financial and legal advantages will be enjoyed by those undertakings in which the State, country, or local authorities have a financial interest. Financially they will have the right to issue bonds for a certain amount, and legally they will have the right to work free of charge lands under the administration of the State, and to expropriate the immovable property and the incidental rights. It is proposed to establish a technical council in connection with the Ministry for Public Works, consisting of representatives of the country, departments, and communes, scientific institutions, agriculture, industry, and professional associations, and consumers, as well as of workmen engaged with the electrical undertakings. The object of the Council is to give an opinion on legislative and administrative decrees and the measures to be taken to develop the electrical industry.

Railway Electrification in Italy.

A further stage in connection with the projected electrification of various railways was reached on August 21st, when the Council of Ministers gave approval to a decree proposed by the Minister of Transport for the electrification of the railways, which was subsequently submitted for royal signature. The decree aims at the promotion of the production of electrical energy at steam and hydro-electric works, and its utilisation along the railway lines for the purpose of traction, and the utmost freedom of activity is to be allowed to private enterprise which intends to employ capital for the erection of generating works. As the consumer of one-fifth of the total quantity of coal annually imported into Italy, the Railway Administration will have to be considered still as a partial user of coal, as well as of electrical energy produced by third parties. The decree provides that preference shall be given to national industry in the execution of works relating to the production of energy, the transmission along the lines and the electrical equipment of the railway network. It was originally proposed to electrify a total length of 1,240 miles of the State railways, but the length under the decree has been extended to 3,720 miles of lines, most of which were enumerated in this journal on August 22nd. The decree foresees a credit of 800,000,000 lire distributed over eight years solely for the purpose of equipping the railways, and further credits are provided for the acquisition of rolling stock and for the subsidies to be paid, as recently mentioned, for the stimulation of enterprise in the establishment of hydro-electric works.

The Big German Firms and Their Competitors.

It is now some years since the special electrical engineering works and the independent installation firms in Germany gave public expression to their opinions in regard to the competition and monopolistic tendencies of the few big firms in that country. Apart from specialising in certain branches of the industry, the so-called special works are composed of the remainder of the general electrical engineering firms which produce most kinds of machinery, plant, and apparatus, whilst the independents are installation contractors who are free from the control of the big firms, and whose interests lie in co-operating with the special works. The number of workmen and officials employed by the special works and installation firms was 70,000 several years ago, and they now claim to give occupation to over 100,000. It is uncertain whether they still possess a representative association, but this is quite immaterial as a firm prominent among the special works has just come forward to give a welcome to the Bill for the socialisation of the electricity supply industry on the ground that it meets the wishes of the special works, and at the same time advantage is taken of the opportunity to drive another nail, not in the Hindenburg statue, but in the monopoly of the big firms.

It may be recalled that the special works for many years past have been compelled to continue a hard fight against the monopoly efforts of the big firms. During the course of this period it has been found by experience that without the enactment of legislative measures it is impossible either to remove the existing monopoly or for the State to secure a large interest in the supply of electricity in different parts of the country. Why? Because the contractors—that is the big firms—for generating station equipment have prevailed upon the station owners, whether companies or local authorities or their own subsidiary companies, to enter into agreements for all renewals or extensions to be carried out by themselves; and other agreements have been also concluded which conferred upon the contractors or their nominees a monopoly of the installation work and equipment in connection with the distributing network of the generating stations and the so-called over-land stations. At one time, and after considerable agitation, several of the former Federal States were induced to issue orders to their respective State officials forbidding them to sanction any agreements which would have the effect of conferring monopoly rights in regard to the execution of installation work and the supply of plant for installations connected with distributing mains from a public service. But all these orders had no effect in the face of secret agreements and other factors in the situation.

It is now thought in circles of the special works that the State is the suitable undertaker for the establishment of large works for the purpose of production, but not for that of distribution, as if the latter were also vested in the hands of the State the special firms consider that they would lose a big market which they have only secured after many years of hard work. After the State, as the premier authority, it is urged that public bodies in the form of unions of communal authorities should also be permitted to undertake generation, but joint undertakings of local authorities and private enterprise are not recommended, as even if manufacturing firms were to hold the minority of the capital, they would, as consulting engineers, look after their own interests to the detriment of the special works, the independent installation firms, and the consumers. Under these circumstances the Socialisation Bill is given approval by the special works, who have certainly selected an appropriate time for opposing the existing monopoly possessed by the big firms. It remains, of course, to be seen whether any greater measure of success will attend the present movement than the agitation of years ago. The only surprise is that the special works have not brought forward specific instances of comparatively modern date in order to strengthen their case against the competitive policy of the big monopoly, for which no contract is too large and no order too insignificant to execute, so long as it provides work, and keeps the works of lesser importance and the independent contractors out in the cold.

Unbalanced Three-Phase Loads.—When the load on a three-phase generator is not balanced, the armature reaction demagnetising the field pulsates at twice the frequency of the machine. The resultant pulsation of flux induces alternating current in the field iron and heats the magnetic structure, possibly sufficiently to damage the insulation. According to the *Electrical World*, the General Electric Co. recommends that waterwheel generators should not be operated with greater difference between maximum and minimum phase current than 66 per cent. of the rated full load current. This figure should not exceed 30 per cent. for turbo-generators with forged field pieces, or 15 per cent. with turbo-generators with laminated poles. The maximum out-of-balance current for turbo-generators having solid rotors should not exceed 15 per cent. if the end rings holding the rotor windings are not insulated; in modern turbo-generators, however, the end rings are usually insulated.

BUSINESS NOTES.

Industrial Conferences.—We understand that the 100 industrial conferences arranged by the National Alliance of Employers and Employed for harmonising the relations between Capital and Labour have been attended by 25,000 industrial firms and 2,500,000 workers. Joint Area Committees have been established in a large number of centres, and other Committees are in process of formation in Brierley Hill, Dudley, Exeter, Glasgow, Grantham, Keighley, Newport (Mon.), Preston, Swansea, and Wigan. The autumn arrangements include the following:—August 30th, meeting of Trade Union representatives in Birmingham; September 1st, joint meeting in Runcorn; September 4th, joint meeting in Mansfield; September 10th, joint conference in Stoke-on-Trent (representatives of all industries in North Staffs.); September 18th, joint conference in Winchester. The conferences will be addressed by either Lieut.-General Sir Edward Bethune (chief organiser), or Mr. T. Ernest Jackson (Labour organiser). Further conferences during October and November are to be held in Bolton, Kidderminster, Bury, Cambridge, Dewsbury, Hereford, Leeds, Leicester, Lincoln, Northampton, Oldham, Rugby, Stafford, Stourbridge, Bedford, and Luton.

Export Trade.—We have received from Mr. A. T. Stewart, of Mansion House Chambers, Queen Victoria Street, London, E.C. 1, a copy of his pamphlet on "Indian and Eastern Export Trade." Its object is to bring before British manufacturers his organisation for the development of export trade. Copies will be sent to firms who are interested, on application.

Annual Outing.—Messrs. J. H. Tucker & Co., Hay Mills, Birmingham, works and offices closed on Saturday, September 6th.

Phœnix Park Sports and Recreation Association.—The Welfare Organisation at the Thornbury, Bradford, works of the Phœnix Dynamo Manufacturing Co., Ltd., founded and financed by the employés, has now got well on to its feet. The 70 acres of ground which have been leased, and which will probably ultimately be bought, include areas for various sports and recreations, and substantial portions for poultry and allotments. The sporting areas include cricket, football, tennis and bowling grounds and a nine-hole golf course. There is a bandstand where concerts take place on Sunday evenings, also concert and dance halls, the opening performance in the former being arranged for September 6th. There is a large billiard room, a room for whist drives, and dressing rooms, reading rooms, canteen and kitchens. Harriers', walking, and hockey clubs have started. Cups and trophies for the various sports and for the allotment holders have been provided by the firm and friends. The scheme, as a whole, is said to be the first of its kind in the country.

Dissolutions and Liquidations.—Rushmores, Ltd., manufacturers of ignition and lighting sets, batteries, &c., Peterborough Road, Parsons Green, London, S.W.—A meeting of the creditors of the above was held on August 26th, at the Cannon Street Hotel, London, E.C., when Mr. O. Sunderland, of the Automobile Trades Guardian Association, 15, Eastcheap, E.C., was elected to the chair. Mr. Sunderland stated that the shareholders of the company had passed resolutions in favour of voluntary liquidation, and had appointed him to act as liquidator. He submitted a statement of affairs, which disclosed liabilities to unsecured creditors of £53,522, while the assets were estimated to realise £37,540. From the latter amount had to be deducted £24,939 due on debentures, and £1,600 in respect of preference claims. The net assets available to meet the claims of unsecured creditors were thus reduced to £11,001, or a deficiency as regarded the unsecured creditors of £42,521. The issued share capital of the company was £19,037, and as regarded the contributories there was a deficiency of £61,558. For the moment no value had been placed on the patents and goodwill. The principal creditors were the Ministry of Munitions, whose claim had been agreed at £40,000. The last balance-sheet of the company showed the position as at July 31st last, and it disclosed a debit in the profit and loss account of £42,072. The deficiency was attributed to the losses on trade, together with the amounts written off the assets for the purposes of the statement of affairs. The chairman further stated that the company was formed in May, 1912, with a nominal capital of £20,000, divided into 7,500 6 per cent. cumulative preference shares of £1 each and 12,500 ordinary shares of £1 each. The company was originally known as Rushmore Lamps, Ltd., and it took over a business from a company which had a similar name. In 1917 the name was changed to Rushmores, Ltd. In December, 1917, debentures for £30,000, bearing interest at the rate of 5 per cent., were issued. The first holders were Messrs. Cox & Co., but they had since been transferred to the British Safety Blades, Ltd. The first balance-sheet of the company covered a period of 18 months' trading, and it showed a turnover of £46,575, with a gross profit of £17,072 and a net profit of £1,927. Since that date the turnover of the company had been as follows:—1914, £31,295; 1915, £36,350; 1916, £388,266; 1917, £776,680; 1918, £210,059; and 1919, £81,925. In 1915 the gross profit was £10,659, but in the following year it increased to £27,176, and in the succeeding 12 months it rose to £30,385. In 1918 the gross profit fell to £1,480, while during the last 12 months there had been a gross loss on the trading of £8,994. In 1914 there was a net loss on the trading of £3,593, but profits were made during the following three years, the high-water mark being in 1916, when there was a profit of £12,663. In 1918 there was a net loss of £24,128, and in the past 12 months the net loss had amounted to £30,400. In answer to a question, Mr. Sunderland said that the reason for the present position was the conditions which had arisen out of the war. While hostilities were in progress the company undertook war work. There was a contingent claim of some thousands of pounds by a late traveller of the company, who claimed he was entitled to 1 per cent. on a certain turnover. At the present moment he could not admit that anything was due, but if on further inquiry it was found that anything was owing, it would be included with the liabilities. On the motion of Mr. E. H. Hawkins (Messrs. Poppleton, Appleby & Hawkins), seconded by Mr. A. Houston, a resolution was unanimously passed in favour of voluntary liquidation of the company being continued, with Mr. Sunderland as the sole liquidator, and an informal committee of five of the principal creditors was also elected.

The following are amongst the more important creditors:—

Ministry of Munitions ..	£40,000	Radmore & Co.	£457
Cashmere, H. W., & Co. ..	281	Lenanton, J., & Sons	156
Armstrong, Stevens & Son ..	111	Locke, Blackett & Co., Ltd...	127
Bond Bros.	557	The Gray Co.	268
Dandridge, J. & A.	200	"The Commercial Motor" ..	105
Weston, Ltd.	203	Camelinat, E., & Co.	967
British Ebonite Co., Ltd. ..	246	Bowden Wire Co.	123
Callender's Cable and Construction Co., Ltd.	138	Spencer, Chapman & Messel, Ltd.	126
Cabinet Co., Ltd.	131	Fulham Borough Council ..	124
Sankey, Joseph, & Sons ..	102	St. Helens Cable & Rubber Co.	375
Aircraft Manufacturing Co...	162	Cubitt, W., & Co.	113
"The Motor"	171	Hughes Label Co.	101
Dee, W. H., & Co.	194	Matthews Bros., Ltd.	193
Gas Light and Coke Co. ..	100	London Electric Wire Co. ..	174
Grey & Marten	188		

Godak Water Power and Manufacturing Co., Ltd.—Winding up voluntarily. Liquidator, Mr. W. Lethbridge, of 9, King William Street, E.C. 4. Meeting of creditors, Sept. 12th.

Electric and General Lighting Engineering Co., electrical engineers, 1, Station Road, Farnham, Surrey.—Mr. J. B. Collier and Mr. F. J. Goring have dissolved partnership. Debts will be attended to by Mr. J. B. Collier.

Mr. M. Pedder, of 169, Smithdown Road, Liverpool, informs us that he has entirely severed his connection with the Electric Light and Motor Co., of Liverpool, in which firm he was until recently a partner.

London Battery Co., battery makers, Wilton Road, Hackney.—Mr. V. C. Bond, Mr. E. W. Clarke, and Mr. C. C. Wilson, have dissolved partnership. Mr. E. W. Clarke and Mr. C. C. Wilson will continue the business under the same style at Hesketh Road, Forest Gate.

Forest City Electric Service Supply Co., electrical engineers, electricians, and dealers in electric service supplies, 39, Chapel Street, Salford, Lancs.—Messrs. S. T. and E. Quilliam have dissolved partnership. Mr. S. T. Quilliam and Mr. A. T. Craston will continue the business under the same style and at the same address.

The Government Scheme of Long Term Credits for Export.—An office will shortly be opened under management appointed by the Board of Trade for furnishing sterling credits in accordance with the scheme for assisting the exportation of goods to certain disorganised parts of Europe.

The credits will be based on bills drawn in this country by the seller of the goods and accepted by the buyer, and will be subject either:—

(*a*) To the deposit with an approved bank in the country of purchase of currency to an amount required by the office, or

(*b*) To a guarantee of currency of a required amount by an approved bank, or

(*c*) To arrangements for the handing-over of produce of the buying country, or

(*d*) To the deposit of securities with the approved bank or the office under the scheme.

The office will fix periodically the amount of currency required to be deposited per £100 sterling, and will have power to vary its charges according to the nature of each transaction. The credits will continue for such periods as the office may determine in each case, having regard to the economic prospects of the country concerned and the character of the business, but the maximum period will be three years. The charges for each period of six months will be on a rising scale in order to induce early liquidation.

The office will be entitled:—

(*a*) To take over and liquidate collateral pledges.

(*b*) To have recourse against the acceptor of the bill for any deficiency.

(*c*) To have recourse against the guarantor.

The credits furnished will not as a rule exceed 80 per cent. of the prime cost of the goods sold, plus freight and insurance (including the charge made by the office). In special cases, however, at the discretion of the executive, the amount may be increased, but in no case will it exceed the prime cost plus freight and insurance (including the charge made by the office). If the proceeds of the bill are less than the prime cost plus freight plus insurance (including the charge made by the office), the loss represented by the difference will be divided between the office and the drawer of the bill in the proportion of four-fifths to one-fifth.

Business will be taken only through banks and on the reports of banks, and the aggregate amount of credit to be granted will not exceed £26,000,000.

The area and classes of goods to which the scheme relates will be settled from time to time by the Government, but credits will not be furnished either for the export of raw material or for the sale of stocks held by Government departments.—*Board of Trade Journal.*

Trade with China.—An engineer with important connections in the Far East wishes to get into touch with manufacturing engineers who desire to develop trade with China and the Far East before he returns to that quarter. We will forward inquiries to him.

Catalogues and Lists.—MESSRS. CLEWORTH, WHEAL AND CO., Grange Engineering Works, Castleton, Lancs.—Pamphlet containing a description and a number of excellent half-tone illustrations of their patent air filter.

THE BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., Trafford Park, Manchester.—A budget of new publicity literature has been issued. A pamphlet of eight pages, in grey cover (7,840/1) describes the company's equipment for individual drive of planing machines; a 24-page pamphlet, similar in style, but in green cover (7,300), deals with large outdoor switches and transformers. The other items in the budget are as follows:—Leaflet D.L. 42/3, on bracket pedestal bearings, as fitted to A.I.F. motors; D.L. 331/1A, Westinghouse type "BB 7" oil switches; three lists, Nos. D.L. 747/2A, D.L. 747/3A, and D.L. 747/4A, giving tabular particulars of Westinghouse electric winding engines, and the mining interests to which they have been supplied at home and abroad; leaflets D.L. 51/1-1 and B.I.L. 51/1-3 specify and illustrate D.C. motor starters, type "S.D."; No. D.L. 381/11 shows Westinghouse motor generators; B.I.L. 368/1-3 relates to oil-immersed forced cooled single and three-phase shell and core-type transformers, and B.I.L. 366/3-3 to single-phase shell type oil-immersed self-cooled transformers.

MESSRS. MATTHEWS & YATES, LTD., Swinton, Manchester.—Price list of "Cyclone" D.C. motors, from $\frac{1}{6}$ to 50 B.H.P., complying with the British Engineering Standards, enclosed ventilated type for continuous running.

MESSRS. HOGAN & WARDROP, 2, Gresham Buildings, Basinghall Street, E.C. 2.—Price list of small E.M.I. motors and regulators, from 1/100 to $\frac{1}{2}$ H.P.—D.C. series or shunt, A.C. single and three-phase and series repulsion types.

MESSRS. FALK, STADELMANN & CO., LTD., 83-87, Farringdon Road, E.C. 1.—Price list P 400 of half-watt and vacuum metal-filament lamps and carbon-filament lamps, and Efesca lanterns.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, near Manchester.—Booklet 2,009, which deals with the charging and operating of "Exide" starting and lighting batteries in ebonite boxes. The instructions are very concise and clear, and should be of great value to users of these batteries; a copy is dispatched with each battery sent out from the works.

MESSRS. MANN, EGERTON & CO., LTD., 5 and 7, Prince of Wales Road, Norwich.—A handsome "souvenir for employés," consisting of a record of "Twenty Years' Progress, in Pictures"; during the war the firm has manufactured seaplanes for the Government on a large scale, including a variety of models and sizes, the total H.P. being over 175,000. The electrical department also carried out numerous contracts for Government departments, and the company took over the operation and control of 300 to 400 farm tractors.

MESSRS. HIGGS BROS. DYNAMO WORKS, Sand Pits, Birmingham.—Monthly magazine and stock list of motors and dynamos, free on application.

French Companies.—Fours Electriques Fenchelle-Tagliaferri is the title of a company newly formed at Paris to work an invention for an electric furnace of a new type in all countries except Italy and her colonies; also the right to take patents for it. The capital is fixed at about 100,000 fr.

A company styled Manufactures du Sud-Est has been formed, with a capital of 100,000 fr, for the manufacture of electric and other apparatus. Its offices are at Lyons.

The Compagnie Générale de Magnétos, of Paris, has decided to increase its capital from 1,000,000 fr. to 2,000,000 fr.

Patents in 1918.—The report of the Comptroller-General states that during the year there were 21,839 applications for patents; 15,662 provisional, and 13,263 complete specifications were lodged, and 10,809 patents were sealed. Applications for designs numbered 10,019, and 9,597 were registered; there were 6,968 applications in respect of trade-marks, and 3,055 were registered.

The receipts from patent fees were £314,431, and from design fees £5,767, representing increases of £22,216 and £355 over the previous year. The total receipts were £345,405, compared with £318,149 in 1917, and the surplus of receipts over expenditure was £135,890, compared with £124,427.

The number of works in the Library at the end of the year was 56,719. During the year the library received from Col. W. A. J. O'Meara, R.E., one of the largest gifts of works recorded in its history, the collection dealing mainly with the professional literature of electric signalling, much of which is unobtainable in the open market.

Renewal fees for patents increased from £219,693 in 1917, to £232,629 in 1918. The number of applications increased by 13·2 per cent., and the number of complete specifications filed by 14·9 per cent. In 13 cases lapsed patents were restored, and one patent was extended for seven years.

U.S.A. Wages Rise 107 per Cent.—According to the New York *Times*, a report just issued by the New York State Industrial Commission says that during the four years since March, 1915, wages have increased 107 per cent., and the number of employés 18 per cent. In March, 1919, there were 9 per cent. fewer workers in the factories of the State than in the same month of 1917, but the pay-rolls were 27 per cent. larger.—*American Machinist.*

An Empire Industrial Organisation.—With the avowed object of promoting co-operation and industrial harmony amongst employers and employés, the Britannic Industrial Alliance has been formed. Mr. J. Havelock Wilson, M.P., has been appointed chairman of the Provisional Committee, and Mr. Ben. H. Morgan, vice-chairman. Mr. C. Jesson, M.P., is hon. secretary, and amongst the members of the committee are Mr. G. N. Barnes, M.P., Mr. J. R. Clynes, M.P., Mr. J. Hodge, M.P., Sir Robert Horne, M.P., and Mr. G. H. Roberts, M.P.

The aims of the organisation, as explained in the *Daily Chronicle*, are "to bring together all associations of employers and employés in this country which are now working harmoniously under Whitley Industrial Councils or similar working agreements, and organisations and individuals interested in developing British trade and British markets.

"These will be placed in direct touch, through the offices of the Royal Colonial Institute, with similar organisations and individuals in the Dominions and Colonies, so that their efforts in developing the resources and markets of the British Empire may be stimulated and co-ordinated in the best possible way."

It is said that this is the first attempt to consolidate and co-ordinate British industry, labour, and trade, by joint action, within the British Empire, and it is considered that the Dominions and Colonies are ripe for such a movement.

Trade Announcements.—MR. H. E. HAWKES, for eleven years with the Midland E.L. and P. Co., has commenced business as an electrical engineer at 21, Hampton Terrace, Warwick.

Mr. Ernest Harris has retired from the firm of Goodenough and Harris, electrical engineers, of Rackfield, Barnstaple, and the business will be continued by Mr. Henry Goodenough.

MR. J. E. HORSBURGH, who represented Messrs. Robinson and Hands in the Midlands, has left the firm and started on his own account, with 33, Western Road, Wylde Green, Birmingham, as his present address. He desires to receive lists of motors, cables, &c.

As from September 1st, arrangements have been made whereby Messrs. Crowther & Osborn, Ltd., will assume entire control of the SCEANDO LAMP CO., and after that date all orders issued or given to the Sceando Lamp Co. will be given and accepted in the name of Messrs. Crowther & Osborn, Ltd. The combined business will be under the same management as heretofore. In order to cope with the increasing demands for its manufactures, the firm has recently opened premises at Bollington for the manufacture of electric lamps.

MR. GEORGE MORRISON, Electrical Engineer, Blackpool, has opened his new premises at 6, Victoria Street, Morecambe (H. Shorrocks, manager), and will be pleased if electrical firms will kindly forward catalogues and price lists to Morecambe.

New Employers' Federation.—*The Times* states that a Federation of Civil Engineering Contractors has been formed, under the presidency of Lord Cowdray, comprising in its membership practically all the large civil engineering contractors in Great Britain. The main object of the Federation is to act collectively through an elected Council in relation to professional institutions and public authorities, and to deal with Trade Unions and other labour organisations in regard to hours of work, rates of pay, and all other matters appertaining to the employment of labour. The secretary is Mr. E. J. Rimmer, and the offices are at 40, Broadway, Westminster, S.W. 1.

Government Sales.—The current issue of *Surplus* gives particulars of a sale of electrical plant, at Oldbury, on September 8th and following days, and of plant offered for sale by private treaty or public tender, including motors, electrolytic cells, motor-generators, electric winding plant, a floating electric power station, electric capstans, wharf and other cranes, generating sets (many of them new), and a great variety of minor electrical apparatus, as well as large quantities of other classes of goods. An article on the adaptation of surplus plant to industry mentions the use of a "tank" engine to drive the electric plant in a Belfast printing works during the recent strike.

German Engineering Trade.—Dr. Ed. Sorge, chairman of the German Engineering Works Union, at the shareholders' meeting held in Berlin, said that the Union had been very adversely affected by the occupation of the left bank of the Rhine. Out of a total of 540,000 employés, 106,000 were in the occupied territory. If German economic life were to be put once more on a sound basis, it would be necessary first of all to restore its economic unity. The German iron industry, an industry of paramount importance for the engineering trade, would be very hard hit. The amount of iron exported should be so adjusted that a sufficient supply remained for the needs of this trade.—*Financier.*

Athens Exhibition.—King Alexander of Greece has consented to open the Exhibition of British Manufactures organised by the Federation of British Industries in Athens. The event will probably take place on Sunday, October 19th, but the Exhibition will be open to trade visitors on the date already fixed—October 13th (October 1st O.S.).

Electrical Development Association.—We have received a number of publicity pamphlets from the Association—Nos. E.D.A. 16 and 17 dealing with electricity in relation to coal economy, labour saving, &c., and No. E.D.A. 6 on heating and cooking. These can be obtained from the Association.

Book Notices.—*Welfare and Welfare Supervision in Factories and Workshops.* Issued by the Home Office. Price 2d. net.—This useful pamphlet is intended to provide employers with information regarding welfare work in factories, and to promote interest in the subject. It is pointed out that, valuable as such work was in war time, it will be even more important in the future, and must be regarded as a permanent element in factory organisation. Briefly defined, welfare work is the provision by the management for the worker of the best conditions of employment. Hence it covers a wide range of considerations. In this pamphlet the subject is dealt with under the heads of General Health, Prevention of Fatigue, Safety, and General Well-being and Efficiency of the Worker; information is also given regarding the selection of the worker, welfare outside the works, the organisation of welfare work, the qualifications and training of supervisors, consultation between employers, and safety committees in workshops. As a handy guide to the employer, the pamphlet will be extremely useful.

A New Era in Street Lighting. London: Holophane, Ltd.—The national watchword of to-day is "Economy," and any device which induces economy should be welcomed by all. It is well known that, in order to make the best, and therefore most economical use of a light source, it is necessary to equip it with some device which will re-direct the rays of light into those paths where they are required. Since the most efficient form of reflector is a simple glass prism, it naturally follows that a device patterned on this principle should be the most economical in obtaining the desired result. The engineers of the Holophane Co. have now designed an enclosing globe for use with the modern light sources which fulfils the requirements of street lighting so far as the distribution of light is concerned, and, in addition, it is so designed and constructed that the process of cleaning is carried out at a minimum of cost. The booklet before us sets forth in a clear manner the aims of scientific street lighting, viz., economical production and effective use of light, and non-interference with vision. It carefully explains why the distribution of light obtained from modern light sources is not ideal for the purpose, and indicates the lines upon which the street-lighting reflector or refractor needs to be developed. The results of good lighting in public thoroughfares, &c., are emphasised. As a practical ideal, a uniformity (or divergence) of intensity of 5 to 1 is suggested, while 15 to 1 is the greatest diversity considered; this represents an enormous advance on ordinary practice, save, perhaps, in the chiefest of thoroughfares, and we doubt whether local authorities would consider for a moment the expense involved in working to this figure. A comparison of the illumination curves for obtaining these diversities with the normal illumination curve of the bare unit will enable one to understand the necessity for some decided effort to approach the ideal. We cannot agree with some of the statements advanced, as, for example, those contained in the paragraph relative to the imaginary ideal reflector. The types of refractors available are illustrated, together with suitable lanterns and data as to their use; dimensions and weight are given, and characteristic light distribution curves also enhance the value of the booklet. We recommend all those interested in street lighting to obtain a copy, but would caution the reader that he is reading a publication produced for the purpose of booming a particular article.

"*Proceedings* of the Physical Society of London." Vol. XXXI, Part V. August 15th, 1919. London: Fleetway Press, Ltd. Price 4s. net.

"Marconi International Code." By J. C. H. Macbeth. Vol. I, English, French, Spanish; pp. xxiv + 575. London: Marconi International Code Co., Ltd. Price 84s. net.

"Science Abstracts." Sections A and B. Vol. 22, part 7. No. 259. July 31st, 1919. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each.

A Satisfied—Contractor.—In these days of uncertainty and unrest, it is comforting to meet with someone who is thoroughly content with his lot. Mr. Harry Moss, of Bradford, informs us that, since being demobilised, he has reorganised his business, and has more orders in hand than ever before. These include power and lighting installations for Messrs. G. H. Norton and Co., Nortonthorpe Mills; electric-crane motors, warehouse and office lighting for Messrs. Firths, Bradford; power, lighting, heating, and telephone installations for Messrs. Thewlis & Co., Bradford and Clayton West; gas engine, shafting, dynamo, switchboard, and wiring for the Lofthouse Motor Co., Shipley; two generators and switchboards and wiring for Albert Mills, for Messrs. F. W. Banister & Co.; extensive lighting installation at West End Mills for Messrs. Arnold Bros., Ltd., Bradford; power wiring and lighting for Mr. Henry Nicholls, Bradford; complete lighting installation for St. Luke's Church, Bradford, and a large number of private houses, shops, &c. We congratulate our correspondent, and hope he is only one of many in the like case.

LIGHTING AND POWER NOTES.

Accrington.—The borough surveyor has been authorised to proceed with such excavations and structural alterations to existing buildings as are required for the proposed extension of plant at the electricity works.

Algiers.—New Generating Station.—The generating station at present supplying Algiers is insufficient for the needs, and a scheme is being considered for building a new station of 60,000-kw. capacity. The existing station at Hassein-Dey cannot be extended owing to the scanty supply of condensing water, and difficulties in coal transportation. It is proposed to build the new station on a mole, so that it may be as near the sea as possible.

Argentina.—Water Power.—The Minister for Foreign Affairs, Sr. Azeveno Marques, interviewed regarding the Argentine project for the exploitation of the famous Iguazu Falls, declared that it had already been presented to Brazil unofficially, and that although he could not definitely state what Brazil's attitude would be in the matter, as he had not been approached officially, there would be no opposition on the part of Brazil. He was quite sure that the rights of both Republics over the falls would be protected, as this could be effected by investigation and report by a Commission representing both countries.—*La Nacion.*

Ascot.—Proposed Price Increase.—An application is being made by the Ascot District Gas and Electricity Co. for powers to raise the price of electricity from 9d. to 1s. per unit. If granted, this will be the second increase allowed this year.

Australia.—Sydney.—The following comparative figures showing the increase in the business of the City Council's electricity department between May, 1914, and May, 1919, were recently submitted to the Council:—On May 31st, 1914, number of consumers, 10,280; 1919, 28,830; increase, 18,540, or 180 per cent.; the units sold, 1914, 3,331,686; 1919, 6,993,534; increase, 3,661,848, or 110 per cent.; the average price received for all units sold in 1914 was 1·88d.; 1918, 1·72d., decrease 0·16d.

Barnes.—Price Increase.—From Michaelmas the following tariff will be in force:—Lighting, 5d. per unit net; prepayment meters, 4d. extra for every three units consumed; contract tariff, 3d. per week per 20-watt lamp for the maximum number in use at one time; power, heating, and cooking, 2d., with the following discounts:—1,000 units per month, 5 per cent.; 1,500, 10 per cent.; 2,000, 15 per cent.; 2,500, 20 per cent.; 3,000, 25 per cent.

Barnstaple.—Price Increase.—The T.C. has increased the price of electricity as under, as from September 30th:—Lighting, from 7d. to 8d. per unit; meter rents, from 1s. to 1s. 6d. per quarter; power, 3d. per unit, with the following sliding scale:—First 5,000 units, 2½d.; next 6,000, 2d., and a further reduction of ½d. beyond.

Bedwas.—Prov. Order.—The South Wales Power Co. is to apply for a prov. order for electric lighting, and will be prepared to supply in bulk under a scheme to be presented to the Council.

Bradford.—Mill Electrification.—Work is in hand for the conversion of a quarter of the motive power at the silk mills of Messrs. Lister & Co., Bradford, and it is expected that the change will be completed before the end of the year.

There is talk of the desirability of having lighting and cooking apparatus installed in all the houses erected by the municipality under the housing schemes.

Bromley (Kent).—Price Increase.—The E.L. and P. Co. has applied to the B. of T. for an order to alter the tariff for electricity from 13s. 4d. up to 20 units per quarter and 8d. beyond, to 9d. per unit.

Burnley.—Price Increase.—The charges for lighting are to go up ½d. per unit, making the cost to the consumer 4½d. The new scale for power is approximately an advance of one-tenth of a penny per unit.

California.—Water Power Shortage.—With demands of industries and public utilities in northern and central California upon hydroelectric systems greater than last year, and with streams lower than last year, the immediate power future is viewed with concern by power users. The situation has not been changed with relation to California, but the temporary shortage of water has placed an unusual burden on public utilities of Idaho. In order to supply sufficient energy to permit farmers to pump water, provision was made for temporarily curtailing commercial and city lighting service, if necessary. The shortage was due in a measure to the fact that a new power station of the Idaho Power Co. was not completed in the time anticipated, but the station is now running, and the power shortage has been obviated in the Boise district. The latest advices, says the *Electrical World*, are that the power situation in Idaho is now well under control.

Chislehurst.—Price Increase.—Power is being sought to raise the price of electricity from 8d. to 9d. per unit over 20 units.

Colne.—Price Increase.—Charges for lighting purposes are being increased by a further 25 per cent. on pre-war rates, making a total increase of 75 per cent., and by 30 per cent. for power, making a total of 85 per cent. The charge for power for tramways is to be increased by 10 per cent.

A minimum charge of 30s. per annum has been put into force.

Extensions.—H.T.-cable extensions are in hand to meet increasing demands, and the question of bulk supply is under consideration.

Continental.—France.—Typical of the difficulties of the present times, and with a view to procuring coal for the various electric generating and distributing companies serving Paris, these latter, to the number of 10, have formed a company styled Office des Charbons des Secteurs Electriques, with a capital of 200,000 fr.

The coal problem in France is threatening to come to a head even before the winter, says the *Times*. The electric power stations

have been obliged to limit the power produced, and certain electricity works have even informed a number of factories in the Paris region that they may only be able to supply the necessary amount of electrical energy between certain fixed hours. It is not only a question of a scanty coal supply, but also of bad coal. The strictest public economy in lighting and heating will be necessary, and it is possible that the brilliant lighting of shops and restaurants, as well as the use of electric signs, which have been permitted for some time, will again be prohibited. The public has already begun to feel some effects of the shortage, particularly in the lack of power supplied to the underground railways. The trains are running at a reduced speed.

With a capital of 15,000,000 fr. the Société Electrique du Nord-Ouest (Nord-Ouest Electrique) has been formed, whose scope is the obtaining of public and private concessions in the North and West of France, and the production, distribution, and sale of energy for all purposes. Its strong directorate represents 12 firms, mostly mining and metallurgical concerns.

Darwen.—Whitley Council.—Darwen Electricity Committee has approved of the electrical undertakings and Trade Unions forming a Whitley Council for Lancashire and Cheshire districts.

Dewsbury.—Restrictions Removed.—A meeting of representatives of the Dewsbury and Batley Corporations and the Spenborough and Heckmondwike D.C.'s, last week, unanimously withdrew the recently-imposed restrictions on the use of electricity by the tramway companies, power consumers, and entertainment proprietors in these areas, in consequence of the coal supply shortage, which is now improving.

Doncaster.—Price Increase.—From September 3rd, an increase of ½d. per unit will be charged beyond the existing advance on pre-war rates for power and lighting.

Dorking.—Price Increase.—Edmundson's Electricity Corporation has applied to the B. of T. for an order to alter the charge for electricity to 9d. per unit, in place of 13s. 4d for 20 units per quarter and 8d. per unit.

Dundee.—Water Power.—Lord Provost Sir Wm. Don, Mr. Hynd, convener of the Electricity Committee, and Mr. Harry Richardson, electrical engineer, have visited various districts in the Western Highlands, with the view of obtaining information regarding the utilisation of water power for the generating of electricity in connection with the proposed Corporation scheme involving an expenditure of £1,000,000. Special attention was given to the development of Kinlochleven and the resources of the Tummel Valley. A report on the subject will be submitted to the Corporation Electricity Committee.

Dutch Indies.—Water Power.—The Dutch Government has taken active steps to examine the available water power in the areas that hitherto have not been fully explored, says *De Ingenieur*. The Bem-Brem waterfalls on the Kajan river in the southern and eastern parts of Borneo, and the Tangga waterfalls on the Asahan river on the east side of Sumatra, have been examined, and a second and greater fall above the Tangga falls was discovered. Other experts have examined rivers and lakes in the central and southern parts of Sumatra. The available water power thus far discovered amounts to at least 500,000 H.P. Power stations of 100,000 H.P. and above can be established in several districts. While investigations in Borneo and Sumatra were in progress, the Department for Water Power and Electricity paid special attention to possibilities in Central Celebes in connection with iron and nickel deposits in the Malili district. The rivers La Rona, Kalaena, Posso, and Laà were examined, and available power amounting to 500,000 H.P. has been discovered there, more than one-half of which is on the Posso river. The La Rona falls can yield 150,000 H.P. at a cost which makes harnessing possible in the near future.

The total power available in Central Celebes and Sumatra is estimated at 1,000,000 H.P., and it is proposed to establish large factories, modelled on the best Scandinavian practice, for the production of nitrates from the air, provided the cost of harnessing the falls proves sufficiently low to permit of commercially-successful operation. The investigations will shortly be completed, and a decision is expected in the immediate future.

Ealing.—Price Increase.—Electricity charges are to be increased from 8d. to 9½d. per unit for lighting.

Egham.—Public Lighting.—The E.L. Co. is to proceed with extensions of public lighting at an extra charge of 17s. 6d. per lamp.

Ellesmere Port.—Prov. Order.—The Sutton and Hooton Gas Co. is to apply for a prov. order for E.L. supply in the Council's area, and at Overpool.

Epsom.—Strike.—Although the U.D.C. refuses, for the present at any rate, to re-engage the cable jointer whose dismissal led to the strike, the men who have been out since August 21st, decided on Friday last to return to work as a result of a conference between representatives of the U.C. and the E.T.U.

Fleetwood.—New Plant.—Additional plant is to be purchased for the electricity works, including a 600-ampere battery.

Godalming.—Price Increase.—The Urban E.S. Co. has applied for an order to charge 10d. per unit in place of 13s. 4d. and 8d.

High Wycombe.—Price Increase.—The E.L. and P. Co. has applied for an order to charge 9d. per unit, instead of 13s. 4d. for 20 units, and 8d.

India.—Ootacamund.—We understand that satisfactory progress has been made with the hydro-electric scheme at Sandynulla or Waterfall Shola, 5 miles from Ootacamund. In addition to the Kundah River hydro-electric scheme, which is a much larger one, the Sandynulla scheme has been engaging Government attention for the past three years, and it is believed a decision as to which scheme will be adopted, will be made shortly.

Cauvery.—The report of Mr. S. G. Forbes, chief electrical engineer to the Mysore Government, for the past year, states that the fifth installation of the Cauvery power works was practically completed during the year. A 5,600-H.P. turbine was run for test and was ready for final speed and pressure regulation tests, when the top half of the spiral casing of the turbine developed a crack. Orders have been placed with Messrs. Escher, Wyss & Co. for a new top half casing to be delivered as early as possible. The report also says that the total quantity of power generated at Sivasamudram during the year was 980,879,000 units, as against 89,369,500 units during last year, showing an increase of 8,718,400 units over that of the previous year. The increase is due to the increased demand for power and lighting in different sections. The cost of the generator, including proportionate interest and administration charges on the capital cost of the plant, buildings, &c., at Sivasamudram was '0931 anna per unit. Adding '0069 anna to the above on account of allowance for margin of safety, the rate for units billed for energy delivered at Sivasamudram to Bangalore and Mysore transmission lines was '10 anna per unit. The report also gives the financial results of the whole of the Cauvery power scheme since the commencement of its operations 16 years ago. The net profit for 16 years is put down at Rs. 1,40,73,273, or an average of Rs. 8,79,579 per year.

Liverpool.—Price Increase.—The Corporation proposes to increase the charges for electrical energy for lighting, power, and other purposes, by a further addition of 10 per cent. over and above the additions of 12½ per cent., 17½ per cent., 10 per cent., and 25 per cent., to the charges already in force, except where the charges are subject to adjustment according to variations in the price of fuel.

London.—St. Pancras.—The completion of an extension of the power-house is to cost £73,300, which is double the pre-war estimate.

Hammersmith.—As from September 29th, the charges for private lighting will be increased to 6d. per unit, and for power, including public lighting and special supplies, by a further 25 per cent., making a total increase of 50 per cent.

New Zealand.—Auckland.—The City Council has decided to spend £80,000 on the extension of lighting and power services to the suburbs.

Hamilton (N.Z.).—The Borough Council proposes to raise a loan of £30,000 for an electric supply scheme, and for the provision of machinery for a water supply.

Hora Hora Scheme.—The directors of the Warhi Goldmining Co. have arranged to sell the Hora Hora hydro-electric undertaking to the Government, which will, in future, supply power to the mines and works on terms nearly similar to those it charges for supplying power to consumers at Christchurch, The sale price is £212,500 payable at a later date, the Government in the meantime setting off £10,625 per annum, being 5 per cent. on £212,500, against the cost of the power it supplies to the company.—*Financial Times.*

Mirfield.—Loan.—The District Council is to apply for power to borrow £3,196 for electric lighting in connection with the local housing scheme.

Peterborough.—Inquiry.—Mr. W. M. Selvey has been appointed consulting engineer to inquire into the organisation of the electricity works, at a fee of 200 guineas, plus out-of-pocket expenses.

Ramsgate.—Price Increase.—The E.S. Co. has applied for an order to increase the maximum price for electricity from 8d. to 9d., or 50 per cent. on the pre-war rate.

Shipley.—Price Increase.—An increase in charges for electricity to small users for power is to be made.

Stamford.—Price Increase.—The Urban E.S. Co. has applied for an order to substitute a maximum charge of 10d. per unit for lighting, instead of 7d., up to 91 hours of supply, 4d. up to 182 hours, and 2d. beyond, and 6d. for power, instead of 4d., for 91 hours, and 1½d. beyond.

South Africa.—Water Power.—The *S.A. Mining and Engineering Journal* announces the probability that the Victoria Fall, on the Zambesi river, will soon be utilised to generate electricity for distribution on the Rand. The Victoria Falls and Transvaal Power Co. came into existence about 13 years ago; the original scheme of utilising the water power of the Falls entailed a large capital expenditure, and a transmission line some 600 miles in length, and it became evident that generation locally from coal would be more economical. The company holds a concession permitting the development of 250,000 E.H.P. at the Falls, while steam plant operating on the Rand has a total capacity of some 280,000 H.P.

Cape Province.—The Caledon Municipality proposes to raise a loan of £16,000 to carry out an E.L. scheme.

The Mossel Bay T.C. has decided to proceed with an E.L. scheme, estimated by Mr. C. G. Trevitt, consulting electrical engineer, to cost £30,000, and tenders are to be called for. The installation comprises steam plant in place of suction gas, as originally intended.

Cape Town.—The T.C. has authorised the city electrical engineer to place an order, without delay, for a spare turbine rotor for the 3,000-kw. machine, at an estimated cost, packed and delivered f.o.b. English port, of £1,732.

The City Council has reluctantly resolved to place an order to the value of £28,278 for new electrical plant with the General Electric Co. of America. Several British tenders were received, and the difference in price in favour of America was not considered material. Unfortunately, the plant is urgently required to avert a threatened breakdown of the electric system, and, owing to the unsettled industrial situation and other causes, the British tenderers were unable to offer the same prospect of early delivery as their American competitors.

Stirling.—Extension of Supply.—The B. of T. has granted an order authorising the T.C. to supply electricity for purposes other than power to premises outside the present area of supply.

Twickenham and Teddington.—The B. of T. has refused the application of the E.S. Co. for power to alter the price of electricity from 7d. to 8d. per unit for the present, and has deferred coming to a final decision until the results of the actual working of the undertaking in 1919 are known. The application had reference to orders from Twickenham, Teddington, Hampton, Hampton Wick, and Ham.

TRAMWAY AND RAILWAY NOTES.

Bolton.—Price Increase.—The Electricity Committee has increased the price of electricity for tramway purposes from 1·14d. to 1·35d. per B. of T. unit.

Brighton.—Time Extension.—The B. of T. has extended the time until August 7th, 1920, of the Brighton, Hove, and District Railless Traction Act, 1911.

Continental.—Germany.—Further facilities for travel are required for the opening up as a residential district of the zone between the 7 and 10-km. circles from the centre of Berlin. This question has been studied by a committee (says *E.T.Z.*), and proposals have been drawn up which consist in the construction of a system of radial high-speed tramways starting at existing or proposed stations of existing railways. The high-speed tramways will be intermediate in their nature between railways and tramways. They will run along roads on tracks that are railed off from the thoroughfare. The ordinary town tramways in Berlin are found to attain average speeds of 28 km. an hour. The proposed tramways will attain average speeds of 32 km. an hour. A line similar to the proposed type is already running at Dahlem, and the cost of building the system is stated to be much lower than that for the construction of railways. A total length of track of 110 km. is planned.

Darwen.—All persons travelling between 6 and 8 a.m. and 5 and 6 p.m. are to be allowed to do so at workmen's fares.

New Cars.—Three new cars are to be purchased.

Dover.—Compensation.—The compensation expenses in the tramway accident, which resulted in 11 people being killed and 61 injured, were on Monday officially reported to have been £14,574 A special rate of 1s. 6d. in the £ is required beyond £1,000 insurance received.

Egypt.—Strike.—The Cairo tramway strikers have definitely refused to resume work upon the terms offered by the companies at the instance of the Government Conciliation Board. The Governor of Cairo stated that the company would run tramcars, as from September 1st, with a new staff and under full Government protection. The strikers assert that the resumption of the service will be prevented by force. The strike commenced over three weeks ago.

Garston.—The tramway services were interrupted for an hour on the night of August 25th, in consequence of the burning out of a feeder cable. The feeder box is situated on the footpath near the Garston terminus and the electricity station. The faulty feeder was disconnected at Garston, but the firework display continued for about 15 minutes until the feeder could be disconnected at the Liverpool end also.

London.—Tube Stoppage.—Owing to a failure at Lot's Road power house, Chelsea, at 4.20 p.m. on Thursday, last week, all traffic on the underground railways was held up for periods varying from 15 minutes to nearly an hour, after which a restricted service was again worked on all lines. Passengers remained in the trains until the service was resumed. On the City and South London Railway all the lights in the trains, platforms, &c., went out for about 20 minutes. The Central London Railway, which has its own generating station, was not affected.

Derailment.—Inconvenience was caused to eastward-bound passengers on the District Railway, last Friday evening, by a derailment at Whitechapel. A train, which was coming out of a siding, was derailed. The line was cleared in an hour, and by half-past seven the normal service was resumed. Owing to the mishap, trains from the City were unable to proceed further than Aldgate East, where passengers had to alight and go to Fenchurch Street Station, where special trains were provided.

A train broke down in the Strand station of the Hampstead and Highgate tube railway, on Friday evening last, and traffic on that section of the line to Charing Cross was blocked for some time.

L.C.C.—The Tramways Department has decided to reinstate the dismissed men of military age and fitness who took part in the strike of 1915, on their return from the Services. The earlier policy of the Council was to allow the men on discharge to rejoin the tramways as new hands with the loss of all privileges their earlier service had brought them. The men's Union, however, pointed out that the fit men dismissed after the strike were without the L.C.C.'s allowances for dependants while in the Forces, while their fellow-strikers taken back for temporary unfitness for immediate service were given these allowances when called up under the Military Service Acts.

Mansfield.—Proposed Light Railways.—The Light Railway Commissioners have submitted to the B. of T. for confirmation an order for the construction of light railways in the borough of Mansfield, in the urban district of Mansfield Woodhouse and in the rural district of Southwell.

Shanghai.—The Shanghai Tramways Co. (British) has decided to build its own tramway cars. The company has acquired land, on which it will build a factory. Orders for the machinery have not as yet been placed. The company proposes to begin with the construction of 15 cars and seven cars for use in connection with its railless operations.

South Africa.—Cape Town.—The tramway employés struck work on July 19th, and at the time of the mail leaving there was no immediate likelihood of a settlement. A deadlock has so far existed with regard to a conference of employers and employés, as the company, whilst willing to negotiate with the Tramwaymen's Union, will not recognise the Federation of Trades, which has taken up the cause of the men, and insists on appearing at the conference.

Port Elizabeth.—The tramway employés have struck work in sympathy with the men at Cape Town.

Stalybridge.—Fare Revision.—The Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board gave notice last week of important revisions in the prices of electricity and workmen's tramway fares. Single-fare workmen's tickets are being discontinued, and workmen's return tickets are to be issued at double the present single fares.

Tramway Employés' Wages.—The demands of tramway workers for increased wages and the merging of war bonus into permanent wages were again discussed, on August 27th, at a joint meeting in London of the executives of the Transport Workers' Federation, the Tramways and Light Railways and the Municipal Tramways Associations. The executive of the Transport Workers' Federation was met in joint conference held in private. At its close Mr. J. Beckett, secretary of the Municipal Tramways Association, said the transport workers' representatives had suggested that the men's demands should be referred to arbitration, and it was agreed that this proposal be submitted to national conferences of the municipalities having tramway undertakings and the private companies concerned, to be held separately in London this week. The employers' representatives undertook to give the Transport Federation a reply by September 4th.

United States.—Ford Tramcars.—Information is given in the *Electric Railway Journal* from an interview with Mr. Ford concerning the announcement that he was prepared to build a very light tramcar for petrol drive. Mr. Ford has already secured a franchise for the operation of a tramway between the tractor plant at Dearborn and the blast furnaces and shipbuilding plant on the Rouge River, a distance of five or six miles. There is, however, no present intention of building the new tramcars on a wholesale scale. It is desired to prove that a very light but powerful car can be built by using high grade steels and alloys similar to those developed for tractor service. One-man operation would be economically essential, and would involve the fitting of many automatic safety appliances. The Ford car would have ball bearings everywhere, and special attention would be paid to the selection of material. The seats would probably be more like automobile seats in order to permit of a high rate of acceleration and braking without discomfort to passengers. All axles would be driven by the engine through worm gearing. It is probable that petrol would be used for starting, and paraffin for normal running.

Worcester.—The T.C. is recommended to commence an action against the Electric Traction Co. for the recovery of increased charges for energy, the company having refused to pay until the Council agreed to the company doing its own repairs to the permanent way. Two firms have objected to the electricity department engaging in trade beyond the statutory powers.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—A Bill to amend the Wireless Telegraphy Act, introduced in the Senate on June 27th, extends the scope of the original Act, which was intended to ensure Government control of wireless services in Australia, to cover wireless telephony as well as telegraphy.

Cable Rates.—The Eastern Telegraph Co. announces that the contemplated reductions of rates between the United Kingdom and the Far East must be suspended pending further arrangements with the Governments interested.

Holland.—Wireless services began between Great Britain and Holland and Scandinavia on Wednesday. Six hours daily are devoted by the Stonehaven wireless station to transmitting to and receiving messages from Denmark, and six hours daily to communications with Holland.

New Cable.—The cable ship *Colonia* arrived at Rio de Janeiro on Sept. 1st, after completing the laying of a new cable from England *viâ* Ascension, St. Vincent and Fayal.

South America.—The Western Cable Co. has protested to the Government against the concession which has been granted to the Central and South American Cable Co. to lay a submarine cable between Buenos Aires and Montevideo. The object of the concession is to enable the American company to extend its communications to Rio de Janeiro. The protest of the Western Co. is justified, because it has a contract with the Government, granting it exclusive rights from 1907 for 25 years.—*La Nacion.*

Sweden.—Negotiations for the establishment of direct telephonic communication between Sweden and Germany, broken off during the war, are now stated to have been resumed.

Wireless Telephony.—A Christiania report states that the Bergen wireless station has on two occasions heard a voice off the American coast. No words were audible, but long and short tones were used to give a message in Morse. Bergen was unable to answer by wireless telephone, but utilised wireless telegraphy, and questions and answers were exchanged.

CONTRACTS OPEN AND CLOSED.

(*The date given in parentheses at the end of the paragraph indicates the issue of the* Electrical Review *in which the "Official Notice" appeared.*)

OPEN.

Annfield Plain.—September 12th. U.D.C. Construction of an overhead L.T. electricity distributing system. (August 22nd.)

Atherton.—September 18th. U.D.C. One boiler plate cubicle. (August 29th.)

Australia.—Sydney.—November 10th. City Council. Supply of electric motors. Particulars from Electric Lighting Department, Town Hall, Sydney.

October 13th. City Council. Three 2,000-K.V.A., 33,000/5,000-volt, power transformers. Electric Lighting Department, Town Hall, Sydney.

Adelaide Muncipal Tramways Trust has decided to invite tenders for a new unit of 10,000 H.P.

Edinburgh.—September 11th. T.C. Three 10,000-KW. turbo-alternators; six water-tube boilers, capacity 65,000 lb. per hour. (August 8th.)

Elland.—September 8th. Constitutional Club. Electric-lighting installation. Specifications from the Secretary, Alfred S. Luty.

Fleetwood.—September 12th. U.D.C. Supply and erection of a 600-KW. battery. (See this issue.)

France.—Paris.—September 12th. Chemins de Fer de l'Etat. Equipment of the sub-station of St. Cloud Parc. Two groups of converters of 120-KW. capacity. Bureaux du Service Electrique, 43, Rue de Rome, Paris.

Grimsby.—September 25th. Electricity Department. Two 1,000-KW. converters and D.C. and A.C. L.T. switchgear; E.H.T. switchgear and cubicles; coal and ash-handling plant; 30-ton electrically-driven travelling crane. (August 22nd.)

India.—Lahore.—Electric Supply Co. Generating plant, two 1,000-KW. and two 500-KW., three-phase, 6,600-volt turbo-alternators, &c.; boilers, mechanical stokers, &c.; sub-station plant, H.T. and L.T. mains, &c. (Specifications available October 1st.) (See this issue.)

London.—Westminster.—September 17th. B. of G. Electric lamps, fittings, &c. Mr. W. J. Lickley, Clerk to the Guardians, Princes Row, Buckingham Palace Road, S.W. 1.

Merthyr Tydfil.—September 8th. B. of G. Electrical accessories for six months. Mr. F. T. James, clerk, High Street.

New Zealand.—Auckland.—City Council is calling for tenders for extensions to the generating plant, cables, &c.

Invercargill.—October 9th. One 1,000-KW., 3,300-volt, steam turbo-alternator, with condensing plant and switchgear.*

Portsmouth.—September 16th. Tramways Committee. 3,200 tons steel girder tramway rails, 180 tons steel fishplates, 40 tons fishbolts, 85 tons W.I. tie bars (5 ft.). (August 29th.)

West Ham.—September 9th. Electricity Department. Lead-covered paper insulated underground cables. (August 22nd.)

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development and Itelligence), London.

CLOSED.

Australia.—Sydney.—City Council. Accepted :—

Steelwork for extension No. 4 at the power house, Pyrmont, £12,985.—Poole and Steel, Ltd.
60-ton travelling crane, with A.C. motors, £7,238.—Standard-Waygood Hercules, Ltd.
50 3-amp., 240-volt, Ferranti D.C. meters; 150 5-amp. do.; 5 25-amp. do.; 5 50-amp. do.—Noyes Bros.
2,500 5-amp., 240-volt, G.E., A.C., single-phase meters; 500 10-amp. do.; 75 25-amp. do.; 10 50-amp. do.—Aust. G.E. Co. —*Tenders.*

Belfast.—City Council. In connection with the new electricity station :—

One 50-ton overhead crane, for engine room, £4,889; one 5-ton crane, £402.—T. Broadbent & Sons, Ltd.
Two 3-ton jib cranes, £9,163.—Armstrong-Whitworth & Co., Ltd.
Centrifugal pumps, £2,810.—W. H. Allen, Son & Co., Ltd.
Water tanks, £1,462.—E. C. & J. Keay, Ltd. —*Irish Builder.*

Tramways Committee :—

Electrical equipment of 50 new cars, at £31,770.—English Electric Co., Ltd.

Darwen.—T.C. Three new tramcars. English Electric Company.

Glasgow.—T.C. :—

Brake track shoes.—The British Westinghouse E. & M. Co., Ltd.
Carbon brushes.—Le Carbone.
Slates.—Currie & Co., Ltd.
Bond plugs.—J. Stewart & Co., Ltd.
Armature coils.—Manchester Armature Repair Co.
Solid drawn brass tubes.—Leslie & Hall.
Toocam brake equipment.—Messrs. Dryers, Ltd.
Trolley cord.—Messrs. Joseph Cookson, Ltd.
Motor-driven air compressor.—Messrs. Alley & McLellan, Ltd.
Storage tank.—Ministry of Munitions of War.
Tickets (3 months).—Glasgow Numerical Printing Co., Ltd.
Steelwork for garage at Pinkston power station.—Messrs. Redpath, Brown and Co., Ltd.

Sunderland.—River Wear Commissioners. Two 15-B.H.P. electric motors, with auxiliary fittings, £541. British Westinghouse E. & M. Co., Ltd.

FORTHCOMING EVENTS.

British Association for the Advancement of Science.—Annual convention. At Bournemouth. From September 9th to September 18th. Tuesday, September 9th. At the Winter Gardens. Presidential address on "Engineering and the War," by Sir Chas. A. Parsons.

Chief Technical Assistants' Association.—Thursday, September 11th. At Anderton's Hotel, Fleet Street, E.C. At 7 p.m. Discussion on Messrs. Young & Ingram's paper on "Modernisation of Street Lighting."

NOTES.

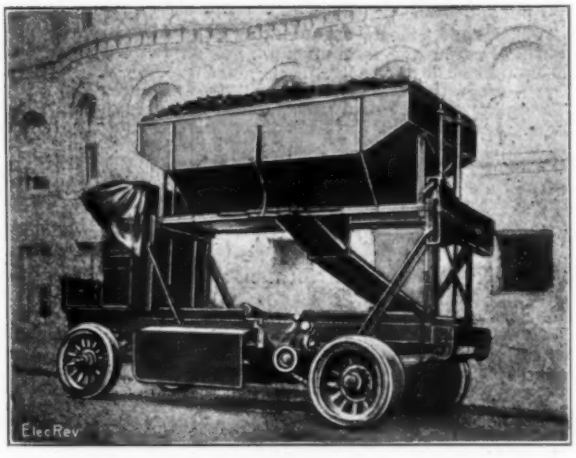
Lead Report.—Messrs. G. Cawson & Co. state that the market last week was quiet, and prices showed very little variation. The speculative buying of forward lead has ceased for the present. The unsold stock in the hands of the Government is possibly not more than 60,000 to 70,000 tons. Arrivals have been very light, and there are no prospects of any increase.

Messrs. James Foster & Co. report that closing prices are about 5s. per ton down on the week, at £24 15s. August to £25 10s. for December. The electrical trades are busy, while there is a fair demand for export.

Power Factor in Contracts.—The *Electrical World* gives a *résumé* of information presented at a meeting of the Boston Section of the Amer.I.E.E. concerning work done in New England in power-factor improvement. In future New England power contracts will embody a power-factor clause based on 80 per cent. minimum, penalties being imposed for lower power factor (probably 5 per cent. between 70 and 80 per cent. power factor, 15 per cent. between 60 and 70 per cent. power factor, 25 per cent. between 50 and 60 per cent. power factor, and 50 per cent. below 50 per cent. power factor. With the exception of the larger consumers, it is felt to be more economical to install large condensers in the sub-station than smaller condensers in consumers' plant. The Boston Edison Co. is penalising power factor under 80 per cent. in the case of all consumers having 50 KW. or higher demand.

The Review of the Foreign Press.—According to the *Bulletin* of the Federation of British Industries, arrangements have been made to continue the production of the *Technical Supplement* under private auspices.

Electric Vehicle Progress.—We learn from our special correspondent that Milan, Italy, is shortly to be provided with a service of accumulator postal wagons, an influential company having been formed with a capital of 2,000,000 lire for the purpose. The company will work the service and will extend its operations to other Italian cities. Turning to this country we find that the increasing popularity of the electric vehicle for public services is attested by particulars given in the current issue of the *Electric Vehicle*. The Hove Corporation Sanitary Committee has recommended the purchase of four electric tipping wagons (Edison) at a cost of £1,304 each, to be delivered by Christmas, 1919, for refuse collection purposes. The Edmonton Urban Council has resolved to use electric vehicles for the collection of house refuse, and has authorised application for a loan of £8,500 to defray the cost of the vehicles and charging plant. Mr. Cuthbert Brown (engineer) recommended the purchase of five electric vehicles at a cost of £1,304 each, and the provision of the requisite charging plant, estimated to cost £1,893. He advised that four of the vehicles be used for dust collection and the fifth for work on the roads. Southgate proposed to scrap its eight horses and vans and to have three electric vehicles to collect 7,000 tons of dust. The life of a horse on the dust shoot was only two years. The Birmingham Council has decided to purchase 25 Edison accumulator electric dust carts for the collection of refuse in the city at a cost of £32,000. The tender from Edison Accumulators, Ltd., was the lowest sent in. Five vehicles will be handed over by the end of September, nine by the end of October, and the remaining eleven will be available by the end of March next. Mr. J. P. Kemp, M.I.E.E., of Birmingham, states that "with the exception of the Edison accumulators, the entire fleet will be constructed in this country with British materials and British labour, and the greater part of the order will be executed at the new Birmingham factory. Edison Accumulators, Ltd., has introduced into Birmingham a new industry, which will provide workpeople with remunerative employment. When anticipations are realised in the matter of introducing electric vehicles in place of horses for city work, the Edison accumulator itself (which has never hitherto been commercially manufactured in England) will actually be made in Birmingham, under licence, providing an additional new industry



An Unusual Type of Electric Vehicle for the Conveyance of Coal.

in our city." In his annual report to the Glasgow Corporation, Mr. W. Greig (Superintendent, Cleansing Department) says: "Within the experience of this department, the petrol vehicles have not proved entirely suitable for the work of refuse collection, the cost being considerably higher than that of either horse or electric traction. Electric vehicles, on the other hand, have given very satisfactory results, having been found efficient, reliable, economical, and easily driven. It is proposed to place a further order for ten electric machines."

The Southgate U.D.C. has received sanction for a loan of £5,500 for the purchase of three electric dust-collecting vehicles, repayable in ten years.

Water Power in France.—The great national scheme for the development of the hydraulic resources of France which is now before the French Chamber has immense potentialities for the future of the electrical industry in that country. In the first place, its complete realisation will afford occupation for an entire generation of engineers and workmen, it will transform French agriculture, industry and commerce, and even tend to alter the bases of property. The introductory ideas set out by the reporter of the Bill, M. Rerrier, deputy for the Isère, are informative in many aspects. Reviewing the hydraulic resources of other countries, he says although these estimations can only be really approximative, they nevertheless yield certain relative indications. Thus the average flow water power of Norway is estimated at 7,500,000 H.P.; Sweden, 6,750,000; Austria-Hungary, 6,750,000; Italy, 5,500,000; Spain, 5,000,000; Switzerland, 1,500,000; Germany, 1,450,000; and Great Britain, 963,000. France, with 9,000,000 H.P., is, therefore, the richest country in waterfalls. Its resources are approximately divided as follows:—Alpes, 4,500,000 H.P.; Central Massif Vosges and Jura, 1,700,000; Pyrenees, 2,000,000; and other districts, 800,000. Of these 9,000,000 750,000 only were equipped in 1913, as follows: 350,000 H.P. in transmission of power and 400,000 H.P. in electrochemistry and electrometallurgy. France thus utilises only one tenth of her available power. In 1913 the capital employed in the hydro-electric industry totalled 800,000,000 fr., or 500,000,000 in the distribution of energy and 300,000,000 fr. in electrochemical and electrometallurgical undertakings. It has been pointed out that Germany and Switzerland make a much better use of their water power than France (31.5 per cent. and 25 per cent.), but M. Cohen questions the correctness of these statements, and emphasises the difficulty of obtaining exact returns. The French situation in 1913 may, however, be summed up thus: available power 9-10,000,000 H.P.; power used, 750,000 H.P., or 8 per cent. Since the outbreak of the war remarkable progress has been made in the utilisation of French water resources. According to M. Cohen, between 1916 and 1918 the water power utilised amounted to 450,000 H.P.; in 1919, 125,000 H.P. was due to be completed; and in 1920-1921, 275,000 H.P.; or a total of 850,000 H.P. The hydraulic power in 1921 would therefore be 1,600,000 H.P., or 16 to 20 per cent. of the available power, such as it has been estimated to be. The division of these new powers, as behoves regions and industries, is as follows: Alpes, 433,000 H.P.; Pyrenees, 185,000; Central plain, 200,000; Jura and Vosges, 35,000; West, 2,000. Divided by their special applications these new forces give: Transmitted power, 308,000 H.P.; electrochemistry, 216,000; electrometallurgy, 326,000 H.P. The new capital invested in the hydro-electric industry amounts to 660,000,000 fr. In 1921 there will therefore be 1,460,000,000 fr. employed in hydroelectric undertakings, or 865,000,000 in transmission; 500,000,000 in electrochemistry and electrometallurgy; and 95,000,000 in electric traction. These extremely remarkable results have been secured by the joint labours of private initiative and Government action. With regard to the latter, it is worth pointing out that the State owns and works three hydroelectric undertakings, one driving a munitions factory, another supplying a cyanide works with power, and a third for the service of the city of Toulouse.—*L'Electricien.*

Measurement of Frequency. — A device has been developed by Schering and Engelhardt at the Physikalisch-Technische Reichsanstalt for the accurate measurement of frequency. According to the *Zeitschrift für Instrumentenkunde*, of May last, a steel tuning fork 240 mm. long and 4.6 by 7.6 mm. in section, is strongly magnetised, and a coil of 1,000 turns of 0.05 mm. copper wire wound on an iron core of 7.6 by 7.6 mm. section is placed between the ends of the prongs of the tuning fork. When the fork is oscillating, alternating currents are induced in the coil, and these are led to a vibration galvanometer tuned to the frequency of oscillation of the fork. If, now, a weak alternating current of a frequency to be measured is passed through the galvanometer simultaneously with the alternating current induced by the motion of the fork, the movement swings in a period corresponding to the beats produced by the superposed alternating currents, and the frequency to be determined may be calculated by the frequency of the beats. The fork can be adjusted in frequency between 40 and 60 cycles a second by adjusting a movable weight, and a displacement of 1 mm. of this weight corresponds to an alteration in frequency of 0.24 cycle a second. Measurements can be made to an accuracy of about 0.1 per cent. Another instrument was constructed that is suitable for measuring frequencies between 140 and 1,000 cycles a second. This instrument is adjusted in frequency by an electro-magnetic method.

Testing Ferrous Materials Magnetically.—An increasing number of students are giving attention to the subject of magnetic analysis as a method of testing ferrous material for quality. The subject attracts by its promise of meeting the demand for means of testing that does not require destruction of the specimen; in other words, instead of studying a selected sample, a method is needed applicable to the material which is to go into actual use—a practical method in the full sense of the word. Five papers dealing with the progress already made in that direction were presented to the meeting of the American Society for Testing Materials in June, 1919. The extent to which work in magnetic analysis had been carried was a revelation to many present. Two generalisations were made: (1) that the principle that there is a very close relationship between the magnetic and the mechanical characteristics of steel is established on a firm basis; and (2) that laboratory tests show that the commercial application of magnetic analysis to shop routine practice is practicable. As a summary of results it may be pointed out that magnetic analysis may be applied to the study of the effects of heat and mechanical treatments, and of the changes that take place during, or as a result of, alternating, repeated or continued stresses; that it may be used to detect flaws in raw material, or in the finished product; that it may be used also, at least in part, as a method for testing high grade steel products, such as cutlery, tools, springs, rails, and parts of automobiles.—*Iron Age.*

Electrical Endosmose.—The phenomena known as electrical endosmose and cataphoresis, whereby matter in a very finely divided or colloidal state is capable of being influenced by an electrical potential, have many applications in commercial processes. Several processes are now perfected sufficiently to be considered from the commercial standpoint. One of the fields for the industrial use of osmosis is in the purification and de-watering of peat, kaolins, ball clays, fireclays, low-grade marls, &c. The process consists in adding to clay suspensions very small quantities of a suitable electrolyte. The suspensions will then act in the following manner: On passing a direct current through such a suspension, the clay particles collect and adhere closely to the anode plate, the water collecting in a zone substantially free from clay round the cathode. Impurities in the original clay, such as muscovite, biotite, felspar, quartz, pyrites, and other minerals are either unaffected and settle out or are attracted to the cathode.

The Osmosis Co. has developed improved machinery for the purpose of treating clay and similar materials according to this process, whereby it is possible to collect the purified clay from the slip, free from impurities. Moreover, the clay so collected contains only from 20 to 30 per cent. of water, thereby greatly reducing the time and cost of drying.

The commercial equipment for such a process consists of a blunger, settling tanks, and a rectangular trough in which is arranged horizontally a cylindrical metal anode, surrounded beneath the surface of the slip and at a short distance away from it by a cathode, through which, by some means of circulation, the clay slip is driven. The cylinder is made to revolve slowly, and, by means of a scraper, the dried purified clay is collected. The improvement produced in the clay by the purification process has, amongst others, it is claimed, the following results: Many low-grade and discoloured china clays, at present unusable, yield by this method both paper and pottery clays. All china clays are improved in colour by this process. The process enables higher yields to be obtained from the matrix out of which the clay is washed, and also enables the clay to be divided into various grades of fineness.

From many ordinary building-brick clays, material suitable for the manufacture of terra-cotta and vitrified red tiles can be obtained. After the osmosis treatment the difference between the sintering and the decomposition temperature may be increased by 100 per cent. or more, which enables such clays to be employed for purposes for which, in the natural state, they are not fitted.

Practically all fireclays are rendered more plastic and more refractory by this treatment. The sintering temperature is reduced often by 200 or 300 degrees. This enables hard bricks to be obtained by burning at low temperature with consequent saving in fuel. Such bricks have obtained their maximum contraction, and do not shrink when built into the furnace.

For glass pots and glass tank blocks these dense highly aluminous vitrified osmosis clays are eminently suitable, particularly as the pyritic iron is entirely removed. Saggars produced from purified low-grade marls have been found to last two to three times as long as saggars made from the raw clay, and, pitting is entirely prevented.

The treatment enables any ordinary red building-brick clay to be purified to such a degree that the purified clay can be used in the making of brown paper instead of mixtures of china clays and ochres. Many fireclays are sufficiently good in colour after the treatment to be fit for making everything except high-grade art papers.

The company's filter press (patented) has been devised to make use of the principle of electro-osmosis. The press works under a hydraulic pressure of about 5 or 10 lb. per sq. in. Moisture is driven out by electrical pressure, enabling water to be removed from very plastic materials. The advantages of the press are as follows: Its construction is simple; wear on the filter cloths is reduced, owing to the low hydraulic pressure; and the time of filtering is reduced.

The filter press can be used for filtering commercially a number of substances of peat, clay, kaolins, and slimes obtained in the course of chemical operations, the handling of which, at the present time, entails much trouble and inconvenience.

It is possible to remove from a solution of gelatine the ash or inorganic mineral matter so that an ashless gelatine, suitable for photographic purposes, can be obtained. Crude glue and glue-yielding substances can also be subjected to treatment by this process. The products so obtained have greatly improved properties.

Improving the Quality of Gray Iron by the Electric Furnace.—Mr. G. K. Elliott, in the *Proceedings of the American Electrochemical Society*, says that all ordinary grades of gray iron—those with medium and high percentages of phosphorus—cannot be melted more easily or more economically than in the cupola. From the standpoint of process alone, the cupola is almost impeccable; but from the high ground of product, it shows serious faults. The cupola is not a refining furnace. Supertenacious and solid iron demands either the elimination of the cupola or the introduction of a duplex process. For a superheating furnace, supplemental to the cupola, there are several eligible types, among which is the electric furnace. For really extraordinary castings Mr. Elliott believes the electric arc furnace presents the most promising possibilities. Experience in manufacture has indicated that the basic-bottom electric arc furnace is the best auxiliary for the cupola in a duplex process for the production of truly high-grade gray-iron castings. Carbon regulation, total as well as combined and graphitic, is possible to a most useful extent in the electric furnace, and the basic electric furnace removes most of the sulphur while the metal is being superheated. Another advantage is the possibility of making furnace additions of manganese and other elements for particular purposes without having to expect more or less appreciable losses; the manganese losses are *nil*. The electric furnace duplex process for gray iron is not recommended as a commercial practicability for ordinary iron castings under ordinary circumstances, but rather as a convenient and extremely efficacious substitute for the cupola process for extraordinary castings or for extraordinary circumstances.

Governing Steam and Water Turbines Operating in Parallel.—A case is mentioned in the *Electrical Review*, Chicago, in which trouble was experienced with steam and water-driven generators operated in parallel, owing to the steam governors being considerably more sensitive and rapid in action than the water governors. The difficulty was overcome by introducing static friction to delay the action of the steam governors at the first instant of the change in load, without affecting materially the action once the change had actually occurred. However, the deliberate introduction of friction introduces an element of danger. Also, the restraining device accelerates wear and necessitates more frequent adjustment. It would be preferable to secure closer parallel operation by making the regulation of the steam governors as poor as that of the water governors. The steadying device applied to the steam governors is described as follows: A rigid beam parallels the governor beam (of the Curtis turbines of the General Electric vertical type), the pivot point being anchored to the frame. One end is connected to the base of the synchronising spring and the other is attached to a leather-faced clamp, which grips the rod connecting the governor beam to the floating lever. The clamp is fitted with an adjusting screw for varying the friction, and with a release so that it may be quickly disconnected. No dangerous tendency towards racing when dropping load suddenly has yet been observed, and the turbine load can be adjusted in increments as low as 50 KW. by the governor control in the operating gallery.

Coal Transport Re-organisation Scheme.—With a view to assisting in the restoration of normal conditions, it has been decided by the Board of Trade that the restrictions imposed on the transport of coal by rail under the Coal Transport Reorganisation Scheme shall be suspended as from September 1st until further notice. In order to give effect to this decision a general permit has been issued, and it will not be necessary until further notice to apply for permits in individual cases after the above date. This decision does not affect the instructions at present in force to suppliers of coal as to the maintenance of supplies to their existing customers.

French Railway Electrification.—An official summary has just been published in Paris of the report prepared by the members of the mission which recently paid a visit to the United States in order to investigate the question of electric railway working in that country. The mission was appointed by the Government at the request of the Committee of Investigation which is examining the schemes presented for the conversion to electric traction of 6,200 miles of the systems of the Paris-Lyons and Mediterranean Railway, the Orleans Railway, and the Southern Railway. The report, which is signed by M. Mauduit, professor at the Faculté des Sciences of Nancy, refers first to the four systems in use on main lines throughout the world, namely, the monophase, the triphase, the monotriphase, and the high-tension, direct current. The professor gives the preference to the last mentioned system, which is said to be yielding remarkable results on the Chicago, Milwaukee, and Saint Paul Railway; and the almost complete absence of disturbances in telephone and telegraph lines through the use of direct current is claimed to render this system considerably superior to the others. It is considered impossible, however, to draw immediate conclusions from the working results in the United States, because the locomotives there are from two to three times more powerful than those in Europe, the goods trains are from two to three times longer, and the driving staff less numerous. As to the conditions under which electric traction would be more economical than steam locomotion, the report submits that this can only be ascertained by detailed calculations by the companies, particularly by the results of the first schemes carried out, and by having regard to the exact prices for coal. This is amplified by the statement that the economy will be specially considerable on lines having large declines and heavy traffic, whilst it is asserted to be probable that electric traction will be more onerous than steam locomotion on lines largely deviating from these conditions. Notwithstanding this unfavourable assumption, the report concludes that the increasing necessity for economising coal, combined with the great accessory advantages of electric traction, renders it essential for the initial works on the French railways to be executed as soon as possible in view of the progressive electrification of the most important lines of the railway companies previously mentioned.

Large Plant.—It is reported that a British firm is constructing an electric generator of 40,000-H.P. capacity, a record size in this country for a single unit. The set is to be turbine driven, and is destined for an installation in a power station "near" London.

What is believed to be the largest jet condenser built, at any rate in this country, is designed to deal with 83,000 lb. of exhaust steam per hour, and to give 28 in. vacuum with cooling water at 80° F. The injection water enters through 134 spray nozzles arranged in an annulus. The size may be judged from the fact that the body flange is no less than 10 ft. 2·5 in. in diameter. The condenser, built by Messrs. Hick, Hargreaves & Co., Bolton, is to go to the Edinburgh Corporation generating station. A large surface condenser for the Bradford Corporation 15,000-KW. station is also in course of erection by the same firm. It is not the largest condenser on record, but it contains 29,500 sq. ft. of cooling surface, and is designed to give 28 in. of vacuum when passing 200,000 lb. of exhaust steam per hour, with a cooling water temperature of 80° F. A second condenser of the same size is in hand at the same works. The body of the condenser is made in four parts, and large machine-tool capacity was required to handle it.

Some of the largest electrically-driven reversing rolling mills at work and being erected in this country at the beginning of this year, were of the following sizes :—

Size.	Type.	H.P.	Drive.	Make.
38 in.	Cogging	8,800	Direct	Westinghouse
30 ,,	Cogging and finishing	4,800/9,600	Geared	E.C.C.
24 ,,	Bar	6,000/12,000	Direct	,,
32 ,,	Bar and billet	11,500	,,	Westinghouse
40 ,,	Cogging	12,000	,,	B.T.H.
40 ,,	Plate	12,000	,,	,,
29 in./18-½ in.	Universal plate	12,700	,,	,,

Yorkshire Electric Power Co. Staff Changes.—According to a report in the *Dewsbury Reporter*, a gathering of past and present members of the Yorkshire Electric Power Co.'s staff was held at Crow Nest Park, Dewsbury, recently, when the opportunity was taken to have the groups of those attending photographed as a souvenir, as, in consequence of various staff grievances, over 15, including several senior and long-service members, have arranged to leave the company's service. In May the grievances were viewed so seriously by the staff that over 70 members then handed in their notices. Subsequently an agreement was arrived at with the board of directors and the management, as a result of which the notices were withdrawn. It, however, appears that matters have not improved, but rather have grown steadily worse. Tea was afterwards served in the old Mansion House, when the members were joined by friends, and after music, farewells and good wishes were expressed.

In the *Yorkshire Post* of August 27th there appeared a manifesto from the E.P.E.A. with regard to the alleged grievances of the members of that organisation who are also members of the staff of the Yorkshire Electric Power Co., followed by the comments of the chairman of the company, Mr. A. G. Lupton. He stated that some time ago the company had in hand several large extensions, but owing to the introduction of the Electricity Supply Bill these works had to be suspended for the time, and the dismissals were rendered necessary by the resulting reorganisation of the staff. With regard to the resignations, the directors had agreed with the E.P.E.A. to refer the question of increased wages to arbitration; the company had already made additional payments, and the difference of opinion was in respect of the inadequacy of these payments. The Minister of Labour was to appoint an arbitrator.

On August 30th, in the same paper, a reply appeared, signed by Mr. W. Arthur Jones, general secretary of the Association. He said that the negotiations were begun as the result of the resignation of 74 out of 75 members of the staff in May last, but no agreement was reached, and on August 9th it was agreed to refer the question to arbitration. According to Mr. Jones, the Yorkshire Co. was one of 11 power companies which on January 30th, 1919, agreed to pay the advances on the terms of the E.P.E.A. award (9,281), and was the only one with which the Association had had a dispute on this matter. The discontent is attributed to the attitude of the engineer and manager towards his technical staff. Mr. Jones states that at the Conference on August 9th, after four hours' discussion, the directors informed the Association that they proposed "to do nothing." Altogether there were 15 resignations, all of which, except two, were given without having another appointment in view.

Fire.—A fire broke out between 3 and 4 o'clock on Sunday morning at the Broughton Copper Co.'s works, Salford. The outbreak was confined to one section of the buildings, which was completely gutted. The damage is considerable. The cause of the outbreak is unknown.

Fatality.—Mr. Walter Eckersley (43), cotton spinner, Leigh, Lancashire, died at his residence, last week, from electric shock. He had been unwell, and was making preparations for a bath. He connected an electric vibrator to a lampholder and stepped into the water, received a shock, and fell unconscious. Servants knocked the vibrator out of Mr. Eckersley's hand, sustaining an electric shock in so doing. A doctor was called, and artificial respiration was tried for a long time, but without success. It was found that the insulation of the lead connected to the vibrator was defective.

Institution and Lecture Notes.—Electricity Supply Commercial Association.—Mass meetings will be held next week at Manchester (September 8th), Leeds (September 9th), Liverpool (September 11th), and Birmingham (September 13th), at which the general secretary will explain the objects and constitution of the Association to all who are interested and eligible for membership. Particulars appear in our advertisement pages to-day.

South African Institution of Engineers.—Mr. W. Elsdon Dew, M.I.E.E., in his inaugural address as President, alluded to the industrial and economic situation, and said they spoke of labour and labour demands with bated breath; but labour leaders realised, or should do so, that those demands might upset the whole economic position, that a high wage scale did no good if labour was not at work, and if temporarily successful advances were gained in wage scales they brought no ultimate benefit to the community at large, or to oneself in particular, if there was no work to do. It was evident that labour did not realise that the total dividend paid in mining, and any industrial concern, was but a very small percentage of the total turnover which had to be paid out in wages to workmen. Until labour had learned, and was able to weigh up, what such changes in wages bills would ultimately mean to the industry concerned, whether it were mining, manufacturing, or agricultural, all misunderstandings would lead them to difficult positions.—*S.A. Mining and Engineering Journal.*

Appointments Vacant.—Assistant distribution superintendent for street lighting, &c. (£250), for the Wolverhampton Corporation Electricity Department; power house superintendent (£400), for the Stoke-on-Trent Electricity Works; instructors in electrical installation work and electrical engineering, for the East Ham B.C. Education Committee; cable jointer, for the Clacton-on-Sea U.D.C. Electricity Works; switchboard attendant (82s. 6d.), for the Stockport Electricity Department; junior mains assistant (85s.), for the Rochdale Corporation Electricity Works; chief engineer and manager (£400 + 10s. per day temporary allowance), for the Dar-es-Salaam Government Electric Power Plant; meter tester (£230), for the Wolverhampton Corporation Electricity Department; shift engineer (79s. 6d.), for the Peterborough Corporation Electricity Department; borough electrical engineer (£550), for the Doncaster Corporation. See our advertisement pages to-day.

Inquiries.—Makers of an electrically-heated coffee roaster; machines for insulating armature core disks; wire heating elements in substitution for radiator lamps; Barkers' silent knight vibro-massage machine; and electrical trepanning machines for cutting plates for side-lights on ships, are asked for.

An Electrically-driven Tube Mill.—With reference to the article on this subject in our issue of August 15th, in which it was suggested that this was the first instance in which a Pilger mill had been electrically driven, Messrs. Howell & Co., Ltd., of the Sheffield Tube Works and Brook Steel Works, inform us that they have been driving a Pilger mill electrically for over seven years.

Educational.—University of London.—Goldsmiths' College Engineering and Building Departments.—The new session commences September 22nd. For particulars see our advertisement pages to-day.

Ship Salvage.—A new method of attaching wire hawsers to the hulls of sunken vessels, where a diver cannot pass them under, called the limpet system, is described in *Marine Engineering*, of Toronto. The limpet is a soft iron body, carrying a number of drill taps driven by small motors, the current being supplied from the salvage vessel. The limpet is lowered until it comes in contact with the hull of the vessel, when it is magnetised, causing it to cling to the plates. The drills are then started, and after running a predetermined length of time the current is switched off, the limpet is hauled to the surface, and the drills are left tightly fastened in the ship's hull. The ends of these drills are formed into eyes, to which the hawsers can be attached.

Water-Cooling Coal Stacks.—Water is generally unsatisfactory in extinguishing fires in coal stacks. A case is mentioned in the *Electrical Review*, of Chicago, in which different kinds of coal were mixed, and, of necessity, stacked to a depth of 30 ft. and over. The coal pile represented about 45,000 tons, and a fire broke out in the bottom centre of the stack. Several iron pipes 2 in. in diameter were sunk from the top to the bottom of the pile, their upper ends then being connected to fire hose. The city water supply was connected, and after 48 hours the fire was extinguished. Satisfactory results have been obtained since the fire, by driving a 1¼-in. iron rod from top to bottom of the pile at intervals of 3 ft. each way. It is found that when the rod is removed, it leaves a clear hole the full depth of the pile, and provides sufficient ventilation to keep the temperature within safe limits.

Engineers' Wages.—Convened by the Amalgamated Society of Engineers, a private conference of Unions in the engineering industry was held at the Central Hall, Westminster, on September 2nd, to discuss the question of renewing the application for an advance of 15s. per week and the procedure to be adopted. It was decided to approach the Minister of Labour to receive a deputation of the trades represented at the conference in regard to the dissatisfaction created by the last award, and also with a view to securing a further extension of the temporary Wages Regulation Act, which expires automatically in November.

Tramway Goods Traffic in Germany.—During the war, owing to congestion on the railways in Germany, attempts were made to organise the transit of merchandise and other goods, light and heavy, on the various tramway systems. So successful has this been that it is proposed to continue this method of transport in some towns during peace, says the *Zeitschrift des Vereines deutscher Ingenieure*. Various methods of conveyance were followed: (1) ordinary street cars either alone or with trailers attached; (2) electric street locomotives, the official inspection cars sometimes being converted for the purpose; (3) in certain cases the railway wagons were either run direct on the tramway tracks or were placed on special trolleys of the proper gauge of the track. The goods carried by this means consisted at first only of building material and gear for the tramway systems themselves, this material being brought from the railway stations and distributed to definite points. The method was then extended to coal haulage and the transport of ashes, &c., from gas and electricity stations. Certain tramway companies undertook the cartage of milk from the railway stations to the depots, and also the carrying of hot meals from the different communal kitchens. The collection and delivery of single packages was, generally, not undertaken. It is stated that the times of goods transport can be made to fit in with the ordinary passenger traffic. It is always advisable to dispatch the goods traffic *before* the passenger traffic. The arrangement of couplings for the special trailer cars, &c., is easily arranged, special couplings being provided where the coupling centre of the two cars varies greatly. The speed of travel of the goods cars running on the tramway rails is ordinarily the same as for passenger cars. The taking of curves and the provision of proper brakes on the trailed vehicles require careful consideration. The "train attendants" are usually provided by the tramway companies or administrations; while the transit of mails, &c., is generally superintended by the postal authorities. The largest Berlin tramway hauled as many as three postal vans with one tractor car, and during the operation of the scheme conveyed millions of parcels, &c., to and from the railway stations. Some aspects of the cost of this method of haulage and of the different tariffs in vogue during the war are then discussed by the author. Summing up his article, he states that a number of tramway companies have already introduced the conveyance of goods on their systems, thus helping out the shortage of draught animals. Railway trucks are unloaded more rapidly, and thus released earlier. The author believes also that many tramway companies could improve their financial results by dealing with goods traffic, provided they arranged this traffic in hours of non-congestion or at night.—*Technical Supplement to the Review of the Foreign Press.*

REVIEWS.

Physical Laboratory Experiments for Engineering Students. By S. SHELDON and E. HAUSMANN. London: Constable and Co., 1919. Part I., Mechanics, sound, light, and heat. Pp. 134; 40 diagrams. 6s. net.

Although published in this country by Messrs. Constable, this little manual is an American production by two professors of physics in New York. It was prepared originally for the engineering students of the Brooklyn Polytechnic Institute, but has now achieved a much wider popularity as a result of its publication in book form on both sides of the Atlantic.

Part 1 consists of a course of 30 practical exercises, each designed to occupy three hours in the physics laboratory. It is claimed that each experiment has a close connection with engineering work; that each is self-contained; and that the theory given in connection with the experiments is intended to inspire the student to think, all of which is excellent. The first thirteen experiments deal with measurements in general physics ranging from the estimation of areas by the planimeter to calibrating a Venturi meter. There are then nine experiments in heat, including such practical work as estimation of heats of combustion of fuels and thermal conductivity of metals, followed by eight exercises in light dealing with prisms, lenses, optical instruments, and photometry. Each experiment includes a paragraph indicating the object of the test, a brief note on the theory of the method, a description and illustration of the apparatus employed, full instructions as to procedure and tabulation of results, and a suggestive paragraph in which conclusions are drawn or hinted at.

Perhaps the most striking fact about this set of experiments is that in a short course of 30 laboratory periods the student handles practically every essential form of physical measuring instrument. A list of these is thoroughly indicative of the value of the course, for, in every case so far as we can discern, the authors insist upon the instrument being used properly and intelligently: spherometer, micrometer-calliper, vernier calliper, planimeter, stop-watch, balance, scleroscope, testing machine, extensometer, barometer, thermometer, hygrometer, calorimeter, spectrometer, optical bench, cathetometer, microscope, interferometer, diffraction grating, photometer. It can safely be assumed that the engineering student who has been taught to use these with intelligence and accuracy has the foundations of his physics well and truly laid.

In writing such a book the difficulty always arises as to whether it is advisable to describe particular forms of instrument or to retain a general form of treatment, and thus run the risk of becoming vague and indefinite. Our authors have here decided in favour of the former course; this naturally limits the use of the book to laboratories with similar equipment, but it has a compensating advantage in that there is no fear of ambiguity. All laboratories will, of course, possess most of the apparatus described (much of which we are delighted to notice comes from British instrument makers), but the Attwood's machine depicted in fig. 6, the scleroscope, the effusiometer, and the particular types of ophthalmometer and photometer described in the text are not invariably present even in a well equipped laboratory.

But some such limitations must attach to every book of this kind, and it would be invidious to criticise where so much is excellent. We shall certainly look forward to the issue of Part 2 with considerable interest; a book comprising a corresponding course of magnetic and electrical experiments should be of value in technical institutions in this country.

This volume is well produced, adequately indexed, and has a useful appendix of tables of physical constants.

Elementary Lessons in Electricity for Bioscope Operators. By L. CALISCH, A.M.Inst.C.E., A.M.I.E.E. London: Bioscope Publishing Co., Ltd. Pp. x. + 133; 35 figs. Price 3s. 6d. net.

The contents of this little book appeared in *The Bioscope* last year, and are intended to impart to the operator a general knowledge of the fundamental principles of the subject, without going too deeply into it. The author writes clearly and accurately, and within a small compass has contrived to cover a remarkably wide field with considerable skill. How far the book will be successful in its aim depends mainly upon the mental qualifications of its readers, which will naturally vary between wide limits; the author has done his best, with hydraulic analogies and simple diagrams, to enlighten the student, and while we think he might with advantage have omitted certain sections which are not likely to help the bioscope operator, and that some of the illustrations are rather roughly executed, on the whole we must congratulate him on the production of a very readable and instructive introduction to the study of electricity.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Central Station and Tramway Officials.—Darwen T.C. has increased the salary of Mr. F. M. FLETCHER, electrical engineer, to £400 per annum, and that of Mr. G. A. NEWSOME, tramways manager, to £350.

Mr. A. ANDERSON, manager of the Oldham, Ashton, and Hyde Electric Tramway Co., has been appointed to take up a similar position at Peterborough, with the Peterborough Electric Traction Co.

The salary of Mr. J. H. THOMPSON, borough electrical engineer, Colne, in common with other officials, is to be increased by £60 per annum as from July 1st last.

On Friday last, at a dinner and smoking concert given in his honour, Mr. EDGAR MOXON, deputy electrical engineer, was presented with a handsome mahogany timepiece, together with a gold brooch set with pearls to Mrs. Moxon, subscribed for by the staff and employés of the Blackburn electricity works, on his leaving to take up his duties as chief electrical engineer to the South Shields Corporation. Councillor C. Higham, vice-chairman of the Electricity Committee, who made the presentation, spoke in terms of highest praise of Mr. Moxon's 15 years' service with the Blackburn Electricity Department. Mr. Wheelwright, chief electrical engineer, who presided over the smoking concert, expressed his keen appreciation of Mr. Moxon's services and co-operation in the numerous schemes with which they had been associated.

On August 22nd, in the tramway employés' recreation rooms, Musselburgh, a presentation was made to the chief clerk, Mr. W. H. GEERE, on his marriage. Mr. Smalley, traffic superintendent, presided, and Mr. Babb, engineer and manager, made the presentation, which consisted of a case of cutlery. Mr. Small, car shed foreman, also spoke, and the evening ended with an impromptu smoking concert.

General.—Sir Benjamin Johnson has tendered his resignation as Director-General of Factories, and the Ministry of Munitions has appointed Mr. E. C. GIVEN to succeed him.

Prof. JOSEPH ERNEST PETAVEL, D.Sc., F.R.S., M.I.M.E., &c., Professor of Engineering and Director of the Whitworth laboratory at Manchester University, has been appointed director of the National Physical Laboratory, in succession to Sir Richard Glazebrook, C.B., F.R.S., who, after holding the directorship for 20 years, retires on reaching the age limit, 65, on September 18th.

Lieutenant R. H. QUINTON, Hants Fortress Engineers, has relinquished his commission owing to the severity of wounds which he received in action last year. Lieut. Quinton was commissioned in the regiment in August, 1915, and posted to No. 4 Company, which is the Electric Light Company of the corps. He saw much service overseas in the fighting of 1916-17-18, and got his second star in June, 1916.

Second Lieutenant J. A. Metcalf, Tyne Electrical Engineers, has been promoted lieutenant. He was commissioned in the corps in February of last year.

Mr. R. C. Atkinson, Assoc.M.Inst.C.E., A.M.I.E.E., A.M.I.Mech.E., who has for the last seven years held the appointment of superintendent of the power station construction department of the Yorkshire Electric Power Co., has joined the firm of E. L. Thorp & Co. (late Shepherd and Watney), consulting engineers, of 32, Greek Street Chambers, Leeds. The firm will in future practise under the title of "Thorp & Atkinson" at the same address, and will continue to advise upon the application of electrical power to industrial work, and the production of low power costs and economy of fuel.

Major Edward F. Rendell, R.E. (T.), is shortly returning to South Africa to the Victoria Falls Power Co., from which company he was released on indefinite leave to join the Forces. Major Rendell obtained a commission in the Tyne Electrical Engineers, and was later promoted Acting Major in the Corps of Royal Engineers. For his services in France he was awarded the Military Cross, was twice mentioned in dispatches, and was decorated with the rank of a Cavalier of the Military Order of Avis of Portugal.

Mr. H. E. McKrell has been appointed manager of the electrical branch of Messrs. Singleton, Benda & Co., Ltd., London.

Messrs. Balfour, Beatty & Co., Ltd., inform us that Mr. Eric Bergstrom has been appointed by them to take charge of their hydro-electric department.

Obituary.—Mr. H. Hosking.—The death has occurred of Mr. Henry Hosking, who was for ten years on the staff of the General Electric Co. at Witton, Birmingham. He was 68 years of age, and was previously in business at Aberystwyth with the late Mr. Miller as an enamelled slate manufacturer.

NEW COMPANIES REGISTERED.

Ward & Co. (Dewsbury), Ltd. (158,233).—Private company. Registered August 25th. Capital, £10,000 in £1 shares. To carry on the business of motor, mechanical, electrical and general engineers, &c. The first directors are: H. Ward, 2, Ash Grove, Earlsheaton, Dewsbury, electrical engineer; J. H. Ward, The Gables, Wakefield Road, Dewsbury, surveyor; C. E. Wood, The Gables, Wakefield Road, Dewsbury, cashier. Solicitor: C. E. Peace, Bond Street, Dewsbury. Secretary: C. E. Wood. Registered office: Brewery Lane, Thornhill Lees, Dewsbury.

Clark's Neo-Electric Devices, Ltd. (158,199).—Private company. Registered August 23rd. Capital, £1,012 10s. in 1,000 ordinary shares of £1 each and 250 deferred shares of 1s. each. To carry on the business of civil, mechanical, electrical, hydraulic, gas, heating, ventilating, and general engineers, &c. The subscribers (each with one ordinary share) are: H. F. Perry, 8, Park Grove Road, Leytonstone, E.11, cashier; G. C. Baldock, 54, Stroud Road, Forest Gate, E.7, solicitor's clerk. The subscribers are to appoint the first directors. Registered office: 9, St. Helen's Place, E.C.

Dick's Asbestos Co., Ltd. (158,272).—Private company. Registered August 27th. Capital, £100,000 in £1 shares. To take over the business of Dick's Asbestos Co. carried on by W. F. Dick at 47, Fenchurch Street, E.C., and to carry on the business of manufacturers of and dealers in asbestos, fibres, non-conducting coverings, asbestos bricks and cements, engine and pump packings, "Dick's Universal Packing," asbestos tape and joints, canvas and I.R. packings, Dick's "Bestorite" jointing, india-rubber sheeting and insertion, asbestos clothing and gloves, Dick's Parme packing, &c. The subscribers (each with one share) are: W. F. Dick, 47, Fenchurch Street, E.C., asbestos manufacturer; F. R. Williams, 47, Fenchurch Street, E.C., works manager; L. L. Mortlock, 47, Fenchurch Street, E.C., sales manager. The first directors are: W. F. Dick (governing director), F. R. Williams and L. L. Mortlock. Registered office: 47, Fenchurch Street, E.C.3.

Chipperfield, Ltd. (158,088).—Private company. Registered August 20th. Capital, £1,000 in £1 shares. To take over the business of an electrical engineer carried on by F. Chipperfield at Oulton Broad, Suffolk. The subscribers (each with one share) are: C. Chipperfield, 1, Flora Villas, Victoria Road, Oulton Broad, electrical engineer; O. G. Scarle, 1, Fern Cottages, Bridge Road, Oulton Broad, electrical engineer; F. Chipperfield, 69, Worthing Road, Lowestoft, accountant; Mrs. A. Chipperfield, 1, Flora Villas, Victoria Road, Oulton Broad. The first directors are: F. Chipperfield, C. Chipperfield and O. G. Scarle. Solicitor: D. Havers, 14, Bank Street, Norwich.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

British Ever-Ready Co., Ltd. (127,632).—Capital, £200,000 in 115,000 ordinary and 85,000 preference shares of £1 each. Return dated June 13th, 1919. All shares taken up. £85,000 paid on the preference. £115,000 considered as paid on the ordinary. Mortgages and charges nil.

Chiswick Electricity Supply Co., Ltd. (38,854).—Capital, £100,000 in £1 shares. Return dated June 4th, 1919. 62,800 ordinary shares taken up. £62,800 paid. Mortgages and charges £78,700.

Brisbane Electric Tramways Investment Co., Ltd. (67,853).—Capital, £975,000 in 75,000 preference and 120,000 ordinary shares of £5 each. Return dated June 11th, 1919. All shares taken up. £150,120 paid on 30,024 ordinary shares. £824,880 considered as paid on 75,000 preference and 89,976 ordinary. Mortgages and charges, £450,000.

Bury Electrical Plant Co., Ltd.—Mortgage on Monitor Works, Phœnix Street, Bury, registered July 15th, 1919, to secure all moneys due or to become due from company to L.J.C. and M. Bank.

Brotherton Tubes & Conduits, Ltd.—Satisfaction in full registered July 11th, 1919, of charge for £6,650, registered September 26th, 1914.

Power Engineering Co., Ltd.—Issue registered July 21st, 1919, of £1,000 debentures, part of series of £11,500 already registered.

CITY NOTES.

Brown, Boveri & Co.

The report of the directors of the Societé Anonyme Brown, Boveri & Cie, of Baden, Switzerland, to which reference was made briefly in our last issue, deals with the financial year ended on March 31st, 1919. It states that the year for a large part was still under the influence of the circumstances of the war. Orders in adequate numbers and at advantageous prices were received from abroad. On the other hand, a fairly rapid fall took place in the prices of certain materials, and this caused a substantial depreciation of the company's large stocks and of some of the products in course of manufacture and already finished. Foreign exchanges, particularly the German and Austrian, also experienced exceptional depreciation, and account had been taken of this fact in the preparation of the balance sheet. Notwithstanding the general conviction prevailing in Switzerland that the country had a pressing need for the more rapid utilisation of the water powers, no progress in this direction could be recorded. Only a small number of installations commenced during the war were in course of execution, and the preparation of new schemes was only effected slowly and with difficulty owing to the obstacles standing in the way. Among the difficulties, special mention was made of the enormous expenditure on new installations and the trouble experienced in raising new capital. Sale prices were still very high, and the expenses for salaries and wages at the Swiss works had risen during the war from about £320,000 to £640,000 per annum for the same number of the personnel, while, on the other hand, the production underwent a considerable diminution. The wages of the workmen during that period increased on the average by 115 per cent. for skilled men and by 135 per cent. for unskilled labour. The directors state that after a long interruption they are able to give details respecting the company's undertakings in other countries. That which had experienced the greatest development during the war was the Compagnie Electro-Mecanique of Paris, whose share capital was raised to £400,000 just before the outbreak of the war. Since then the capital had been increased by £200,000, together with a loan of £400,000, and a further augmentation was in progress. The company's dividend in recent years had reached the pre-war rate of 8 per cent. In the case of the Technomasio Italiano Brown-Boveri, of Milan, it had been possible to manage with the modest capital of £240,000 until a few months ago, when it was put up to £480,000. The dividend in the past few years had been advanced to 8 per cent., which was the maximum authorised in Italy during the war. The capital of Brown, Boveri & Co., of Mannheim, had remained at 9,000,000 marks, and the company had distributed 15 per cent. for 1916-17 and 1917-18, but a reduction would be made for the past year. The Isaria Meter Works, of Munich, had raised its capital from 2,200,000 marks to 2,750,000 marks during the war, and its dividends to 15 per cent. Proceeding to refer to the Norwegian company—the A. S. Norsk Elektrisk & Brown-Boveri, of Christiania—the report states that the share capital was increased from 2,000,000 to 4,000,000 crowns, and the company had paid 10 per cent in each of the past three years. The business developed considerably during the war, and the degree of activity in Norway was still satisfactory. In the case of the Austrian Brown-Boveri Werke, of Vienna, the capital had been raised from 4,500,000 crowns to 8,500,000 crowns, the result being that the preponderating influence had passed into other hands. The sales companies in Holland and Spain—the N. V. Electriceits Maatschappij "Electrostroom," of Rotterdam, and the Sociedad Espanola de Electricidad Brown-Boveri, of Madrid—had worked particularly well during the war. On the other hand, the business of Brown, Boveri & Co., Ltd., of London, had been very quiet, and the S. A. Belge Brown-Boveri, of Brussels, was only able to resume full activity after the evacuation of Belgium by the Germans, whilst the resumption of business in Russia would be confronted with extraordinary difficulties. Coming to consider the company's Swiss interests, the report first refers to the Alioth Electricity Co., of Basle, and the Gleichrichter A.G., of Glarus. The latter is claimed to be the only undertaking which has succeeded in constructing large rectifiers capable of working and having a capacity of several hundreds of kw. The Scintilla S.A., of Soleure, makers of magnetos, the "Motor" Co., of Baden, and a refrigerating machine company of Glarus complete the list of interests in Switzerland. An abstract of the accounts, indicating a dividend of 9 per cent., as in 1917-18, was given in our last issue. It is now proposed to increase the share capital from £1,440,000 to £2,000,000, although an amount of £480,000 is to be raised as a first instalment.

Tyneside Tramways and Tramroads Co.

The half-yearly meeting was held at Newcastle-on-Tyne on August 27th. Dr. J. T. Merz, who presided, said that their profits for the year were £6,943, and it was pleasing to note that their traffic receipts showed an increase of £2,387. The half-year just ended had been a particularly arduous one. All sorts of things had been altered, and in every direction they had been faced with new difficulties. The hardships of war had ceased, but to a great extent the hardships of peace had, so far, been almost as great. Not the least of their troubles had been the number of holidays which had increased that class of

traffic, but had reduced their ordinary traffic. He referred to the proposal to transfer £2,500 to the credit of reserve for renewals, depreciation, &c., and remarked that that fund had now nearly reached £40,000, which they would have to deal with in connection with the problem of relaying the track when the time came for the work to be done.

Stock Exchange Notices.—The Committee has ordered the undermentioned to be officially quoted:—

General Electric Co., Ltd.—25,000 ordinary shares of £1 each, fully paid, Nos. 1,200,001 to 1,225,000, and 155,790 six and a-half per cent. cumulative preference shares of £1 each, fully paid, Nos. 1,500,001 to 1,655,790.

South Metropolitan Electric Light & Power Co., Ltd.—Warrants for dividends on the 7 per cent. cumulative first preference shares, and the 6 per cent. cumulative second preference shares, for the half-year ended June 30th, 1919, have been posted.

Victoria Falls & Transvaal Power Co.—According to the *Financier* the net earnings, including those of the Rand Mines Power Supply Co., Ltd., for the quarter ended June 30th amounted to £221,656 before providing for taxation in South Africa and the United Kingdom.

Newcastle-upon-Tyne Electric Supply Co.—Interim dividend of 2½ per cent. on the preference and ordinary shares, less tax.

Brazilian Traction, Light & Power.—Quarterly dividend of 1½ per cent. on the fully-paid cumulative preference shares.

City of London Electric Lighting.—Interim dividend of 6 per cent. per annum, less tax, on ordinary shares.

Trafford Park Estates, Ltd.—Dividend 7 per cent.; carry forward £60,365.

STOCKS AND SHARES.

TUESDAY EVENING.

THERE are only two live markets in the Stock Exchange at the beginning of the week, Home Railway stocks to wit and rubber shares. Interest in other issues proved entirely subservient to that which developed, with remarkable suddenness, in these two departments. Rubber shares came along with a boisterous rush, thanks to the recovery, albeit small, in the price of the produce. Home Railway stocks attracted more sober interest because of the better outlook in the labour world. This drew investors to the consideration of the handsome yields offered by Home Railway stocks at existing levels. With present dividends practically guaranteed for at least another three years, the investor succumbed to the attractions of the market, and prices have risen materially. The buying turned mainly to investment stocks affording good returns on the money, and other shares were sold to make room for these. Underground Electric £10 shares accordingly went back to 3¼. The company's 6 per cent. income bonds were quoted ex £2 interest on Monday last, and now stand at 95½. If we assume the interest at the full 6 per cent., the return at this price comes to £6 6s. 4d. per cent. on the money, and as it is paid free of tax, this is equivalent to 9 per cent. on the money, allowing for tax at 6s. in the £. It is to be remembered, of course, that the bonds are dependent upon the income for each year, and the interest is not cumulative. Metropolitans are 2½ and Districts 1½ higher on the week.

Marconis are a dull and heavy market. A fresh fall of 5s. in the price is associated with sales by stale holders, exasperated that the public should not have come in to buy the shares after the first disappointment had worn off in connection with the award made to the company against the Government. While the parent shares have been giving way, Marconi Marines held their ground, and after being down to 2¾, recovered to the present price of 3. It was pointed out here, some little while back, that people who studied the market closely were disposed to regard Marconi Marines as more attractive than the shares of the parent undertaking. The latter have gone back considerably, while "Marines" kept tolerably firm, and a quiet improvement appears to be not unlikely.

Dealers in electric lighting shares continue to maintain that they have buying orders for fair lines, but, again, the price movements do not reflect much support. City of London ordinary rose ¼ on declaration of an interim dividend of 6s. per share, but the preference eased off, and County ordinary are another 2s. 6d. down. Metropolitan ordinary have gained ¼; the shares pay very well on the money, and any which come to market find ready buyers. South Metropolitan preference, and several others, are quoted ex dividend. Just lately an improvement has been scored in various London gas stocks, and it may be that electricity shares will prove the next to receive a measure of investment support. Stock Exchange markets are revolving in curious circles just now, and one department after another receives its turn of prominence.

Cable shares are quiet, the only change being a rise of 10s. in Anglo-American preferred. The Eastern Telegraph Company notifies that the contemplated reductions in rates have been suspended pending further arrangements with the Governments interested. Henley's are a better market, recovering their dividend, and 1-16 in addition. Direct United States at 4⅜ show a decline.

British Westinghouse preference maintain their remarkable rise at 3½, and the ordinary shares are 35s. A good many hundred Crompton preference have changed hands in the last few days, on the basis of 23s. 6d. The ordinary can be bought at 21s. 6d. British Insulated have risen ¼ to 2 3-16, and a rally of 5s. lifted Castner Kellners to 2¾.

The Mexican President anounces a Claims Commission for indemnification in connection with damages resulting from recent revolutions in Mexico. It is stated that the Commission will admit of any proof "humanly reasonable." Strange—or perhaps not so strange—to relate, this magnanimous declaration has left the Stock Exchange cold. There has been no mad rush to buy Mexican Utilities. On the contrary, Mexican Light and Power first mortgage bonds are 2 lower, a truly melancholy commentary upon the lack of appreciation towards such a generous spasm on the part of President Carranza. Foreign traction issues are dull as a whole. In the Indian list, Bombay Electric £10 ordinary have risen to the amazing price of 65. British Columbia Electric stocks are heavy. Adelaide Electric old preference have gone back to 4½, which is, however, ex dividend. The new 5 per cents. keep steady at 19s. 6d., while the partly-paid are relatively a little lower at 9s. 3d. Manila Electric Capital stock has dropped rather sharply to 82½. Victoria Falls ordinary are just below 20s., and the preference remain at 25s.

Rubber shares enjoy such a boomlet as takes the wind out of the sails of oil and other erstwhile popular industrials. No fresh developments of any consequence have occurred amongst armament, iron, coal or steel shares.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price Sep. 2, 1919.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES					
Brompton Ordinary	10	8	6xd	—	£6 13 4
Charing Cross Ordinary	4	4	2⅝	—	7 5 6
do. do. 4½ Pref.	4½	4½	8	— ¼	7 10 0
Chelsea	8	8	8	—	5 0 0
City of London	8	8	11⅛	+ ⅛	6 17 8
do. do. 6 per cent. Pref.	6	6	9⅛	— ⅛	6 3 1
County of London	7	7	9½	— ½	7 7 5
do. do. 6 per cent. Pref.	6	6	9½xd	—	6 4 8
Kensington Ordinary	7	6	5	—	6 0 0
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	6	6	8⅝	—	8 5 6
Metropolitan	4	5	2⅝	+ ⅛	8 13 10
do. 4½ per cent. Pref.	4½	4½	8⅝	—	7 1 2
St. James' and Pall Mall	9	10	6½	—	8 0 0
South London	5	5	2½	—	7 5 6
South Metropolitan Pref.	7	7	1xd	—	7 0 0
Westminster Ordinary	9	8	5½	—	7 12 5
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	94½	+ ½	6 7 0
do. Def.	1½	80/6	22⅝	—	7 13 0
Chile Telephone	8	8	6½	—	5 18 6
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	15½	—	*5 5 0
Eastern Tel. Ord.	8	8	159½	—	*5 0 4
Globe Tel. and T. Ord.	7	8	15½	—	*5 5 0
do. do. Pref.	6	6	10½	—	5 18 8
Great Northern Tel.	22	22	28½	—	7 14 5
Indo-European	13	13	51½	—	6 6 8
Marconi	20	25	5⅞	— ¼	4 16 2
Oriental Telephone Ord.	15	10	9½	—	4 9 0
United R. Plate Tel.	8	8	7⅞	—	*5 8 8
West India and Panama	1/8	1/8	1⅛	—	*4 15 3
Western Telegraph	8	8	16½	—	*4 18 9
HOME RAILS.					
Central London Ord. Assented	4	4	65½xd	—	6 10 1
Metropolitan	1	1½	26½	+2½	4 14 2
do. District	Nil	Nil	23	+1⅛	Nil
Underground Electric Ordinary	Nil	Nil	8½	— ¼	Nil
do. do. "A"	Nil	Nil	8/6	—6d.	Nil
do. do. Income	4	5	95½xd	+1	*5 4 9
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4½xd	— ½	6 13 4
Anglo-Arg. Trams. First Pref.	8¾	Nil	2⅛	— 1/16	—
do. do. 2nd Pref.	—	—	2⅛	—	—
do. do. 5 Deb.	5	5	68	—	7 13 10
Brazil Tractions	—	—	18	— ½	—
Bombay Electric Pref.	6	6	12½	—	4 16 0
British Columbia Elec. Rly. Pfce.	5	5	55½	—1½	9 1 10
do. do. Preferred	Nil	2½	4⅝	—1	5 7 6
do. do. Deferred	Nil	Nil	40⅜	—	Nil
do. do. Deb.	4½	4½	58	—2	7 14 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	57	—	Nil
do. 6 per cent. Bonds	Nil	Nil	46½	—	Nil
Mexican Light Common	Nil	Nil	35	—	Nil
do. Pref.	Nil	Nil	48½	—	Nil
do. 1st Bonds	Nil	Nil	61½	—2	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	33	—	*4 2 9
British Aluminium Ord.	10	10	14	—	6 8 1
British Insulated Ord.	25	12½	2⅛	+ ⅛	6 1 0
British Westinghouse Pref.	7½	8	22	—	4 16 6
Callenders	25	25	9	—	6 19 9
do. 6½ Pref.	6	6½	5½	—	6 3 10
Castner-Kellner	25	20	2¾	+ ⅛	8 0 0
Crompton Ord.	7	10	21/6	—	9 6 0
Edison-Swan, "A"	—	—	1½	—	6 0 0
do. do. 5 per cent. Deb.	4	5	81½	—	6 2 9
Electric Construction	10	10	14	—	8 16 0
Gen. Elec. Pref.	6	6½	1	—	6 10 0
do. Ord.	10	10	2	—	*5 8 0
Henley	25	25	3⅞xd	+ ⅛	6 8 0
do. 4½ Pref.	4½	4½	5¾xd	—	6 4 2
India-Rubber	10	10	17	—	*5 17 8
Siemens Ord.	—	10	1⅝	—	*7 17 0
Telegraph Cop	20	20	26	—	*4 17 0

*Dividends paid free of Income Tax.

BRITISH ELECTRICAL MACHINERY IN CANADA.

By a British Engineer Recently Arrived in England.

The spectacular fall in the dollar exchange has aroused the commercial interests of this country to the necessity of increasing our export trade if we are to escape the poverty and industrial distress to which we appear to be drifting. The one ray of comfort in the situation is that an adverse exchange makes export trade easier, for goods worth a sovereign to us can be sold to-day in New York for about $4.23, instead of at the normal price of $4.86. Hence the American manufacturer has to compete with goods which we can profitably sell in his market at something like 13 per cent. less in his currency than we should have to ask if the exchange were normal. A similar condition prevails with regard to the Canadian exchange, although the sovereign has not depreciated to quite the same extent in Montreal as in New York. Again, the Canadian dollar is worth less in the States than the American dollar, in consequence of the exchange on New York being adverse to Canada.

We propose in this article, however, to deal only with Canadian trade, and the depreciation of Canadian currency in the States, together with that of British currency in Canada, has a double effect upon our prospects of export to the Dominion. In the first place, the American exporter to Canada is handicapped by the depreciation of the Canadian dollar; and, secondly, the British exporter is benefited by the very great drop in value of the £ sterling. Thus we have a twofold advantage over our greatest competitor in the Canadian market, quite apart from the substantial Imperial preference granted by the Canadian Government. Under such circumstances a reasonable effort on the part of our manufacturers should enable them to secure a valuable share of the vast electrical business in the Dominion.

In the past the possibilities of Canada as a market for British electrical machinery have been sadly neglected. With, perhaps, one exception, our manufacturers have made no serious attempt to compete for business with the two great American-Canadian firms which hold a virtual monopoly of the trade. This apathetic state of mind may have been largely due to a feeling that the demand could not be very great in a sparsely populated country largely devoted to farming, as well as to a general, but entirely false, belief that export from Great Britain to a country having a frontage of some 3,000 miles on the United States could hardly be commercially possible. It is true that Canada, as a whole, is not densely populated, and the proximity of the United States is also a geographical fact, yet these considerations do not affect the truth of the statement that there is a very large market for electrical goods, the cultivation of which would be profitable both for the British manufacturer and the Canadian consumer.

The use of electricity in the Dominion has been encouraged to a remarkable extent by the abundance of water power in the East and in British Columbia, while on the prairies where no hydro-electric development is possible, it is also used to an extent little realised in this country. The City of Edmonton uses over 20 million KW.-hours per annum, with a population of 59,000; Saskatoon uses about 13 millions with a population of 26,000, and at Regina practically the same amount is used by 42,000 people. These cannot be called manufacturing towns in any sense of the word, yet it will be seen that their average consumption is about 360 KW.-hrs. per inhabitant per year. Moreover, prior to the war, these and other Western towns were growing at an almost incredible rate, and most of them now appear to show a healthy revival of activity.

If we have carried conviction as to the capacity of the Canadian market for electrical goods, we may proceed to consider the methods by which business can be obtained there. Undoubtedly the only proper way for a firm that can afford to do it is to establish an office and warehouse in one of the large cities with a capable engineer in charge. Sub-offices, in due course, could be opened in other cities from which local inquiries could be handled. This was the method adopted by the British firm to which we have alluded, and so far as a resident in Canada could observe, a very large and lucrative business was obtained. The needs of the country, and of particular customers, could be accurately and promptly conveyed to the home firm, and the purchasers had the satisfaction of knowing that they could get into direct touch with a responsible representative of the manufacturers should occasion arise. This counts for much more, especially in a new country, than many people might imagine. A prospective buyer is very likely none too conversant with machinery, and really competent help is difficult to obtain, so that the fear of not being able to get assistance without writing for it to some unknown firm on the other side of the Atlantic Ocean all too frequently prevents an order being placed in England. We may mention that both the Westinghouse and the General Electric companies maintain offices in practically every town of any size at all in the Dominion. This practice must add considerably to their selling expenses, and as a matter of fact, before the war British electrical machinery, particularly of the larger sizes, was almost invariably quoted at very favourable prices when a quotation could be obtained. A little more energy on the part of our manufacturers in those days would have reaped a handsome reward, and there is no indication that a similar statement would not be equally true to-day.

The necessity, for it is a necessity, of keeping stocks in the country if any reasonable amount of trade is to be done, should be emphasised. Manufacturers must bring themselves to realise that if any article is to be sold in Canada, it has to be sent there at some time or other, and in the case of articles in general use, they should be sent there first. Of course no one suggests that turbo-generators or the larger sizes of transformers should be carried in stock, but small transformers, switches, instruments, motors, and all the ordinary electrical apparatus most certainly should be warehoused there; spare parts, above all things, should be stocked in the country. To be able to forward an article by express from some point in Canada to a customer who needs it acutely, by reason of a breakdown or some other emergency, is invaluable from the standpoint of business-getting. Six weeks is considered the absolute minimum of time required to get an article from England to the centre of Canada, supposing it to be ordered by cable and shipped at once. The time of delivery more usually runs into months, and even then there may be a further exasperating delay if the consignment arrives broken or incomplete.

Another reason for stocking material in Canada is the very short construction season. During the summer months work has to be rushed to completion, as out-door work is practically impossible during the cold weather. Again, the almost incredible rate of growth in the Western Provinces prevents much foresight on the part of the purchaser in placing inquiries, and delivery must follow closely on the heels of the order, price being quite frequently a secondary consideration if quick delivery can be effected. Furthermore, if immediate delivery can be offered of some article which is not exactly the type or size which the customer wants, he will very probably accept it so long as it will do the job.

These considerations should suffice to show how very important it is that our manufacturers should carry stocks in Canada, if they hope to do business there. American machine-tool makers long ago realised the necessity of conducting business on these lines, and in the showrooms of the merchant houses at Montreal, Toronto, Winnipeg, and Vancouver, to mention only the largest centres, the aggregate value of American machinery stocked ready for instant dispatch must run into many millions of dollars. Goods sent from the factories to the various centres are made up in car-load lots, and so get the advantage of lower freight rates, while the "lake and rail" route to the West can also be taken advantage of, as there is no urgency of delivery.

So far as electrical machinery is concerned, the almost universal use of three-phase current at 2,300 volts and 60 cycles reduces the variety of goods to be stocked. There are a few two-phase 60-cycle cities, and there is also a certain demand for 25-cycle machinery, but three-phase, 60-cycle apparatus is all that need be seriously considered. The domestic pressure is universally 110 volts, and continuous current, except for traction purposes, is almost unknown. Transmission is entirely by means of overhead wires, pressure reduction being effected by means of transformers mounted on the poles.

If a British manufacturer wishing to enter the Canadian market feels himself unable to establish a branch house in Canada on the lines we have urged above, his next best plan, though a far inferior one, is to come to some arrangement with one of the large manufacturer's agents who have an extensive business connection in the Dominion. The merit of these jobbing houses varies enormously, and many a British manufacturer has had his business mishandled and his name prejudiced by agents to whom he has almost blindly entrusted his interests. Canadian engineers often express amazement at the foolish confidence placed by British firms in certain classes of agents. Men to whom a resident in the country would hesitate to lend ten dollars, are to be found entrusted with some agency "for the whole of Canada." One sometimes wonders why Australia is not thrown in as well, because it could be handled quite as efficaciously. Unless the British manufacturer is satisfied that the agent has at least resident representatives throughout the Dominion, his territory should be limited to an area he may be reasonably expected to cover. An agent situated in Montreal, for example, is over 1,400 miles from Winnipeg even, and the double journey would take 96 hours in the train. No one can afford to take such a journey on the chance of getting a small order. And how much more foolish is it to expect that a Montreal agent will visit Calgary, the great distributing centre of the Western prairies, often enough to justify his agency. Calgary is over 2,200 miles from Montreal, and Vancouver is nearly 3,000 miles. A realisation of what these distances mean, and how great are the time and expense of visiting such places, should be enough to prevent a manufacturer granting a sole agency for the Dominion to any one party without first assuring himself that the prospective agent is in a position to do him justice.

Supposing, however, that an agent has been decided upon, some arrangement should be come to with him by which he should take into his employment an engineer directly responsible for looking after the manufacturer's business. Such an arrangement ensures proper attention being given to inquiries which concern the manufacturer, and gives confidence to purchasers of the machinery. Moreover, it tends to prevent orders being placed by the agents with a rival firm, which is by no means an unknown procedure even on the part of agents entrusted with the sole selling rights of some particular article. Many a manufacturer is reasonably satisfied with his agents if they place a few orders a year with him, although had his interests been properly looked after, these orders might have been multiplied tenfold. An engineer on the spot, working with the agents, but sent out from the manufacturer's works, is a very valuable asset to business. Such a man must be selected with care and chosen, not because of what examinations he has passed nor what relationship he has with some director of the company, but for what he is, and what he can do. A practical man is above all things essential, and so is a "good mixer."

In conclusion, a few words of advice may be given, which are especially directed to those firms which are not represented in Canada, but which get occasional inquiries from that country. First and foremost, treat the inquiry with courtesy and put forward a full quotation for exactly what is asked for. The customer knows his needs and the local conditions better than you can do. If you feel sure that you can make a better offer along different lines, by all means submit it as an alternative, but let your primary quotation be for what is wanted. Do not decline to quote from a fear that your price must necessarily be too high to be considered. Orders do not go to the lowest bidder as a matter of course by any means, and your competitors are usually at least as much handicapped by freight and duty as you are. Again, let your prices be given in Canadian currency, and your weights in pounds avoirdupois. If the word "ton" has to be used, it must be remembered that the short ton of 2,000 lb. is practically universal in Canada, and it should be specifically stated that the short ton is meant. To find weights given in tons, cwt., qrs., and lb. is irritating, and frequently incomprehensible to the buyer.

There is nothing so foolish, when endeavouring to secure an order, as to exasperate the prospective customer, and there is no surer way of doing this than by quoting in pounds sterling "f.o.r. our works, packing extra" or even "f.o.b. British port." The Canadian thinks in dollars and keeps his books in dollars, and he is no more enlightened by such quotations as we have instanced than a resident in a remote country district of England would be by a quotation in dollars, "f.o.b. Medicine Hat". Moreover, it outrages his natural self-respect that a firm should not think it worth while to state its price in his national currency, and many an otherwise acceptable British tender gets into the waste-paper basket because the purchaser cannot gather from it how much the goods will cost him. The Canadian buyer naturally wants to know how much money he will have to pay, so that he may make a comparison with the cost of other articles offered. Unless he is in one of the larger towns he cannot possibly find out how much freight, insurance and duty must be added to the British price, even if he could make an approximate guess as to the meaning of that price in his own currency at the current rate of exchange. Moreover, why should he worry about it, or put himself to so much trouble, when he has received other tenders which do not need so much investigation and arithmetic on his part?

The extra trouble required on the part of the British firm to quote in an intelligible manner is not worth considering, if Canadian business is really wanted. The objection that freight rates fluctuate, or that the rate of exchange is erratic, is merely an excuse for slovenly tendering. What could be easier than to add a footnote to the tender to the effect that "this price is based on current shipping rates and Customs duties, and on an exchange rate of $4·80 to the £ sterling; should any material change take place with regard to these values, the purchaser will receive the benefit or otherwise of the change"? Or it would be simpler still to put forward a price sufficient to cover any reasonable risk, as is usually done in the case of materials and labour. The main thing is to inform the purchaser what the article will cost him in his own currency, and delivered at his own town. It would do certain of our manufacturers good to hear what is said about some of their methods of doing business, and frequently the strongest remarks are made by those who sincerely wish them well.

As a guide to manufacturers considering business in Canada the following list of prices of electric motors may prove useful. The list represents the retail prices quoted for three-phase 60-cycle induction motors, delivered free on rail at Toronto, during the earlier months of the present year. About the beginning of June, however, a reduction of 10 per cent. in price for all sizes became operative. Motors of the type in question are stock articles, and British makers desiring to enter the market should make arrangements with some reputable importing house, or better still, establish a branch house of their own in the Dominion from which *immediate delivery* of standard motors and spare parts could be given.

H.P.	R.P.M.	Price, $.	H.P.	R.P.M.		Price, $.
1	900	132	20	720	Including starters.	610
1	1,200	118	20	900		548
1	1,800	102	20	1,200		499
5	720	295	20	1,800		455
5	900	253	50	600		1,037
5	1,200	185	50	720		968
5	1,800	149	50	900		850
			50	1,200		783
			50	1,800		776

Electricity in Agriculture in Russia.—According to Russian newspaper reports, the Soviet Government has assigned 22 million roubles (nominally £2,200,000) for a scheme for the use of electricity in agriculture to alleviate the trouble caused by the lack of horses and human labour. Several of the largest German electrical companies have been invited to co-operate.

A NEW BATTERY-CHARGING DYNAMO.

On a recent visit to Chelmsford we were greatly interested in demonstrations that were made of certain wireless telegraphic and telephonic apparatus as used in the field,* in connection with which the Marconi Co. utilises a small dynamo, which forms part of the complete outfit, for the purpose of charging the 6-volt and 20-volt accumulator batteries, which in their turn supply current to heat the filaments of the receiving valves and to feed the H.T. (filament-plate) circuits respectively.

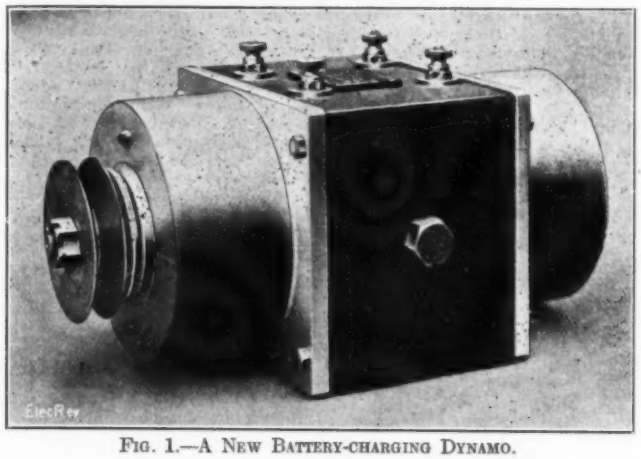


Fig. 1.—A New Battery-charging Dynamo.

We are now in a position to give a more detailed account of this dynamo, which possesses some interesting and unique points of construction; it was designed and manufactured at the works of the East Anglian Engineering Co., Ltd., Stowmarket, being produced in quantities of about 250 at a time.

This firm, like others during the war period, was asked to lend a hand in the manufacture of munitions, and it fell to its lot to manufacture small aeroplane parts. The usual difficulty in obtaining machinery for this work was experienced, and ultimately the firm had no other course than to design and manufacture its own, and a simple single-purpose lathe was evolved. The possibility of using this machine for producing small dynamo or motor parts when the munition contracts terminated was not lost sight of, and, in fact, the machine has turned out quite successful for this purpose. Each lathe is now arranged to complete one or two operations, and is so simple that it is operated entirely by unskilled or boy labour. Practically all the parts in the small dynamo described below have been manufactured on these small lathes. Our illustrations will not need much description; fig. 1 shows the dynamo ready for duty, fig. 2 shows the machine with the end covers removed, and fig. 3 shows its component parts, while fig. 4 illustrates the arrangement of the machine. The dynamo, which is totally enclosed, gives a continuous rated output of 15 amps. at 24 volts on one side, and 1.5 amps. at 45 volts on the other at a speed of from 3,400 to 3,600 R.P.M., and it will withstand an overload of 50 per cent. for 15 minutes. The minimum resistance to earth when hot is not less than one megohm, and 1,000 R.M.S. volts are then applied for 10 minutes. As the whole set had to be portable, the weight was somewhat limited, and it became necessary to have either a wrought or cast-steel frame, the former being obviously the cheaper of the two as far as cost of material is concerned. The difficulty in using it, however, was to form the plates into a suitable shape, and the design eventually adopted is shown in fig. 4. The frame is made of mild steel; flat plates were used, cut from 5-in. by 0.5-in. section bar, the separate plates being cut to the required length and planed in batches of 50, serations being formed on the ends similar to dovetails, which are made to fit into one another under considerable pressure. The ends are made finally secure by rivetting. To test the rigidity of the frame one was dropped from the workman's bench on to a cement floor, after which, it is claimed, no perceptible distortion could be measured. The poles are also made of mild steel, circular in shape, and a malleable cast tip is shrunk on to the pole core and locked by two small grub screws; the whole being finally bored within the frame. The formers are made to fit closely on to the poles and back against the magnet case to allow of the heat being easily conducted away from the former. The machine is excited from the 45-volt commutator, and the shunt watts amount to 6.5 per cent. of the total armature output.

The terminals are fitted in the most accessible position, as shown in fig. 1, it being necessary to quickly attach connections as the dynamo forms are essential part of portable wireless sets.

The armature is built up of thin laminations having open slots; the coils are former wound as used on larger machines. The two windings are wound together, and taped together, so that the total number of coils is equal to the number of slots. The commutators, of which there is one at each end of the armature, are a forced fit on the shaft, the latter being of massive dimensions to overcome the liability of springing when forcing on the commutators.

"Skefko" ball bearings are provided, and are made a very tight hand-push fit on to the shaft. The outer race is supported in a brass housing, which is machined all over, the object being to prevent the outer race of the bearing sinking into the end bracket, which is made of aluminium. This is liable to occur on machines that are driven by petrol engines where a large amount of vibration is unavoidable. In small totally-enclosed machines breakdowns sometimes occur due to the deposit of carbon dust on the brush-holder supporting pins. To minimise such trouble the brush-holders of this machine are of special design, supported on brass spindles which are fixed by screws to the upper portion of the aluminium end

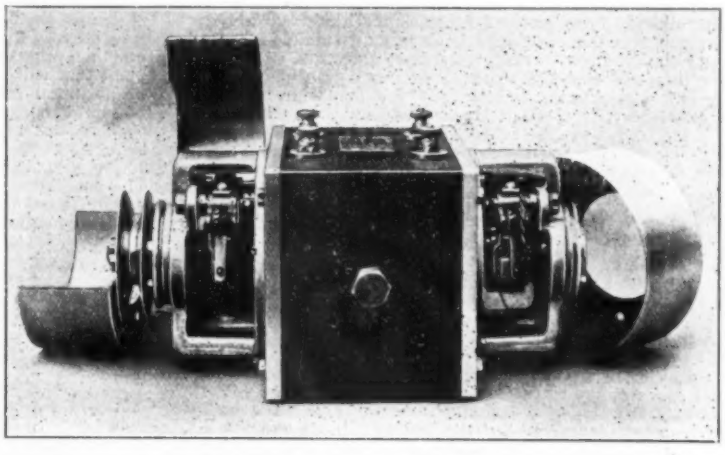


Fig. 2.—Dynamo with End Plates Removed.

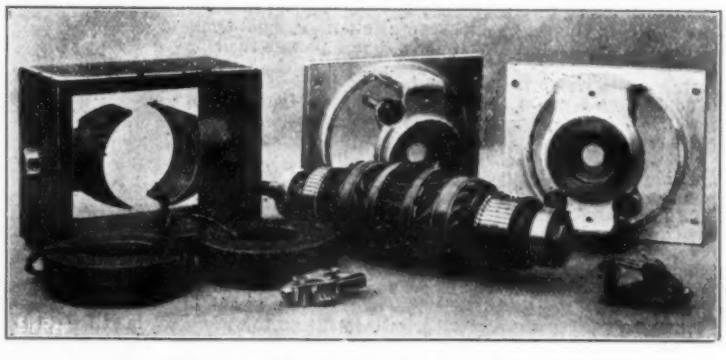


Fig. 3.—Component Parts of Dynamo.

* Elec. Rev., June 6th, 1919, p. 673.

bracket. The brush-holder used has only a supporting ring for the brush, in place of the orthodox type of box, and sticking of the brushes is thereby, it is claimed, practically eliminated. Provision is made for the adjustment of tension on the carbons, and only the carbon is disturbed when a renewal is made. The connections to the terminals are made by stiff copper wire secured by a screw to the spindles, it being only necessary to slacken the screw to remove the connection when taking the machine adrift. Aluminium spinnings are provided to act as end covers at each end of the machine; these are easily removable, making it possible to inspect the brushes and commutators.

The efficiency of the dynamo is 75 per cent. at full load; it has a very neat appearance, the frame being finished in black enamel and the other parts polished. Great accuracy is maintained in manufacturing all parts, the limit on the spindles being 0.25 thousandths. Special jigs and tools have been made to deal with quantity production and to ensure interchangability, so that spare parts can be easily supplied.

In conclusion, we may say that it has been decided to build motors on the same principle as the dynamo just described, suitable for grinding, polishing and similar machines, inquiries having already been received for such machines and also for rotary converters, these machines being most suitable for small battery-charging sets dealing with about 200 watts.

We may add that the machine described was both electrically and mechanically designed by the firm's draughtsman and electrical engineer, Mr. H. C. Waters. We must express our indebtedness to Mr. L. Tibbenham, A.M.I.Mech.E., managing director, for providing facilities to inspect one of these dynamos, and also for providing photographs and drawings.

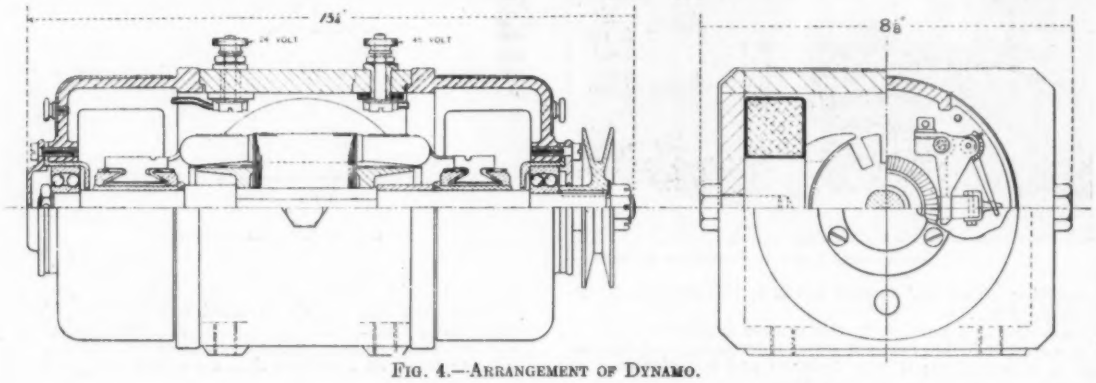


Fig. 4.—Arrangement of Dynamo.

WATER POWER IN CANADA.

Some Recent Developments.

(*Continued from page* 285.)

New legislation on water-power law and regulations, entitled "Bill 94. An Act respecting Dominion Water Powers," was passed by the House of Commons on May 19th, 1919, and is now reported to have passed the Senate without amendment. This Bill, according to the *B. of T. Journal*, was introduced by the Minister of the Interior, who stated in his opening remarks that: "The Bill simply declares what the property of the Dominion is and what the authority of this Government in relation to that property shall be, as regards water powers and everything incidental to water powers, and determines the principle upon which these water powers shall be administered."

Water powers under the Federal jurisdiction have hitherto been administered under Section 35 of the Dominions Land Act, which has been found inadequate. The purpose of the new Act is to provide a more definite system of administration and a more complete utilisation of Dominion water powers.

A preliminary draft of the proposed water-power regulations was prepared in 1916, and was submitted to a large number of the leading authorities concerned in the administration of water powers in other jurisdictions, legal and engineering experts, prominent consulting engineers, manufacturers of hydraulic equipment, &c.

Conferences of the officials of the Water Power Branch were held in 1918, at which each point was exhaustively discussed and a tentative decision reached. A fresh report on the whole matter was then prepared, and is being submitted to further conferences called by the Dominion Water Power Board and consisting of water-power administrators and selected experts.

This report, consisting of three volumes, contains the original draft regulations sectionalised, and criticisms and suggestions on each section made by the authorities to whom it was submitted, the replies and views of the Branch's legal expert, and the actions thereon of the Water Power Branch Conferences. It shows, in fact, all the steps in reaching a considered judgment, on each point, and forms, perhaps, the most complete study yet made of this particular subject. After revision at the final conferences above referred to and now being held, it will constitute the basis of the new Dominion Water Power Regulations.

In the *Canadian Engineer* of June 12th last, a description of the hydro-electric development on the Nipigon River was given, where 60,000 h.p. will be developed, about sixty miles north-east of Porth Arthur, by the Hydro-Electric Power Commission of Ontario, and it is expected that by June of next year two 12,000-h.p. units will be in operation.

The Nipigon River flows from Lake Nipigon to Lake Superior, a distance of about 32 miles. The normal elevation of Lake Nipigon is 852 ft., and of Lake Superior 602 ft. There are at least four power sites on the river, all of which will ultimately be developed by the Commission. South of Lakes Maria and Jessie—near Cameron's Pool—are two sites. The upper site affords 65 ft. net head, is considered to be the most advantageous one on the river, and will be developed first. The drainage area of Lake Nipigon is about 9,200 sq. miles, and its actual area is 1,500 sq. miles. With a minimum flow of at least 4,550 c.f.s., 26,500 h.p. is available as 24 hr. continuous power. The design of the proposed plant includes a regulating dam that can raise the river level to the elevation of Lakes Maria and Jessie, which will form natural storage reservoirs. It is estimated that a peak load of 60,000 h.p. can be taken care of by the normal flow, and that is the size of the plant that will be built.

The initial installation will be two units, each of 12,000 h.p., but three more will be installed at a later date. Single-runner vertical water turbines will be direct-connected to 3-phase, 60-cycle, 12,000-volt internal revolving-field generators, each of 10,600 k.v.a. (80 per cent. power factor, maximum rating). The generators will be arranged for parallel operation and will supply the Commission's "Nipigon System." This development is further west than any other yet undertaken by the Commission. All the construction work will be done by the Commission's construction department.

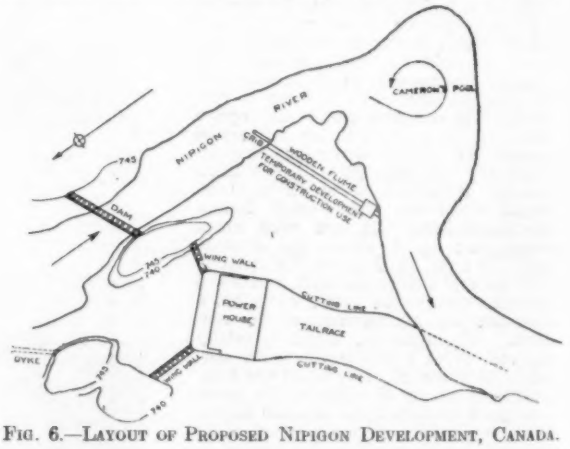


Fig. 6.—Layout of Proposed Nipigon Development, Canada.

Fig. 6 shows the general layout of the development. A dam about 200 ft. long and 43 ft. high will be built across the river above Cameron's Pool. The river bed is rock. The power house will be constructed in the dry, but when the water level is raised the ground to the east of the power house will be submerged and form the forebay 300 ft. long. Wing dams, also to be constructed in the dry, will extend from each of the easterly corners of the power house. The penstocks will be square, tapering from 21 ft. section at the intake to approximately 18 ft. at the scroll case and 80 ft. long, built of reinforced concrete, box section. As can be seen from the general plan of the power house (fig. 8) two penstocks will serve each turbine.

The trash racks will be about 12 ft. behind the stop logs, and the gates about 18 ft. beyond the racks. The distance from the gates to the centre line of turbine shafts will be

80 ft. The velocity of the water will be increased from about 2 ft. per sec. at the intake to approximately 8 ft. per sec. at the scroll case. The turbine casings will be of the spiral, or volute, type, and will be moulded in reinforced concrete. This is an innovation in design for the "Hydro" Commission. Each draught tube, also the power house itself and the dams, will be of reinforced concrete throughout.

For construction purposes a temporary development, fig. 6, is being built near the pool in order to supply light, heat and power for the job. A wooden crib will be built, as shown in fig. 8, and a wooden flume will supply water at 22 ft. head to two turbines which will develop about 2,200 H.P. and drive generators and air compressors.

Specifications for the 12,000-H.P. water turbines were submitted several weeks ago. Each turbine must have a full-gate capacity of 12,000 mechanical H.P. at the generator coupling when operating under a net effective head of 65 ft. and at 120 r.p.m. (The maximum gross head is 69 ft. and the minimum is 61 ft.) The generators will normally be operated at from 60 to 90 per cent. of full rated load. The turbines, therefore, have been so designed that the best efficiency

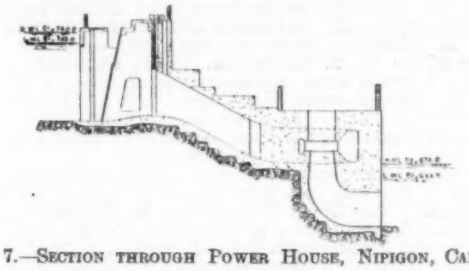


Fig. 7.—Section through Power House, Nipigon, Canada.

obtains with a load of approximately 10,000 H.P. Each turbine runner will be cast iron, the vanes being cast integrally with the crowns and bands. In deciding the award of the contract for the turbines, special attention is being given to the method for providing seal and for overcoming the unbalanced thrust of the runners due to wear.

The speed ring will be made of cast iron in two sections and will consist of upper and lower flanges, connected by approximately ten stationary vanes, cast integrally with the flanges. The vanes will direct the water efficiently from casing to the guide vanes and in addition will act as stays to the upper and lower flanges, to resist the hydrostatic pressure acting upon the casing, and to support all superimposed weight. One of the vanes will provide a steel nose for the concrete at the junction between the end and inlet of the casing. The speed ring will be of such shape as to protect the concrete casing effectively from excessive wear from high velocities of the water, and also such that thin or taper sections of concrete will be avoided at the junction of the speed ring and the spiral casing.

The movable guide vanes will be of cast steel of the balanced wicket type, designed to guide all water, with the least possible eddying, from the speed ring to the turbine runner. They will be pivoted and provided with cranks for outside connections to a cast-steel regulating ring, and will be fitted together, so as to reduce to absolute minimum the

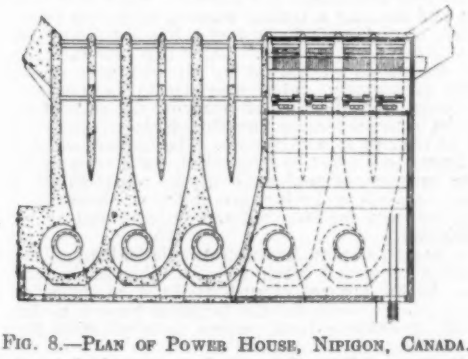


Fig. 8.—Plan of Power House, Nipigon, Canada.

leakage of water when they are in the closed position. The vanes will be pivoted so as to be approximately balanced under water pressure at one-third gate opening and will tend to close to this position from any operating position.

The turbine shaft will be of open-hearth forged steel, with an ultimate tensile strength of 75,000 lb. per sq. in., and an elastic limit of not less than 37,500 lb. per sq. in. The brakes must be capable of bringing the unit to rest from normal speed in five minutes when operated with air at 200 lb. per sq. in. pressure. The governors will be of the water-pressure type and supplied with distant speed controllers, hand-control gate-limiting devices, over-speed shut-down devices, gate-opening indicators, and tachometers. The normal closing time of the gates will be two seconds; the governors must readjust the gates whenever the speed varies more than one-half of 1 per cent. from normal.

After erection tests are to be carried out for a continuous period of at least two weeks. There may also be required a test of each turbine extending at least for a period of fifteen minutes at runaway speed; *i.e.*, under friction load only and with gates full open.

Fig. 6 shows the general layout of the proposed Nipigon water-power development; fig. 7 is a section through the power house, showing the stop logs, trash racks, gates, penstock, turbine setting and draught tube. Fig. 8 is a plan of the power house, and shows the concrete penstocks and turbine settings.

The design and construction of the Nipigon development is being handled by the regular staff of the Hydro-Electric Power Commission of Ontario.

(To be concluded.)

MEASUREMENT OF ELECTRIC CURRENT BY THE RADIOMETER.

The suggestion to apply the Crookes radiometer to the measurement of electric current was first made by Dr. C. E. Hiatt, formerly of Pennsylvania University, U.S.A. He constructed a radiometer with two vanes, each of which faced a thin metallic strip which was connected by leads to binding posts outside the vacuum chamber. Each strip when heated by the passage of current through it would, it was thought, repel the vane facing it. The geometrical relations of heaters and vanes were such that the torques applied to the radiometer suspension by the heaters would be oppositely directed. If the two heaters were joined in series and a current were sent through them a "zero" position of the suspension would be established. If then a current of unknown strength were sent through one heater and an easily measurable current were sent through the other, and the latter were varied in intensity until the suspension should assume its zero position, the intensity of the known current would equal the effective value of the intensity of the unknown.

In a paper communicated to the June, 1919, issue of the *Journal* of the Franklin Institute, Mr. T. D. Cope, Ph.D., also of Pennsylvania University, describes his continuation of these investigations. The instrument as first designed was found after repeated tests to be unsatisfactory; it was abandoned and a new form designed and constructed.

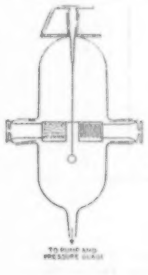


Fig. 1.

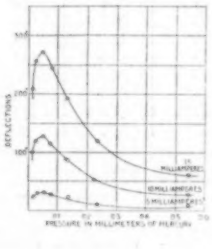


Fig. 2.

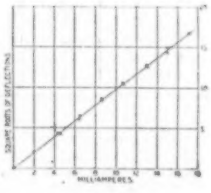


Fig. 3.

A glass vessel was blown approximating a right circular cylinder with rounded convex ends. It was 30 cm. long and 10 cm. in diameter. When in use it stood with its axis vertical. It was provided with four orifices, one of which, coaxial with the vessel at the bottom, led through a stopcock and ground-joint to a von Reden pressure gauge and through a drying-vessel containing phosphorus pentoxide to a Geissler air-pump. A ground-joint coaxial with the vessel at the top, 16 mm. at its greatest diameter, admitted a ground stopper, prolonged into a rod 4 cm. long, from which the radiometer was suspended. The other two orifices were coaxial ground joints; their common axis was a prolonged diameter of the vessel, distant approximately 14 cm. from the top. These joints tapered from an exterior diameter of 3.6 cm. to a diameter of 3.3 cm. where they entered the vessel; each was 4 cm. long, and provided with a hollow stopper provided with a handle. Through the stoppers were sealed platinum leads. Each stopper supported a mica frame which carried a current-bearing heater. To the top of the vessel was attached externally and coaxial with it a horizontal disk 6 cm. in diameter whose limb was graduated in degrees. Over this circular scale moved a pointer rigidly attached to the stopper in the upper ground joint. The radiometer suspension was supported by a quartz fibre 9 cm. long and one-seventieth mm. in diameter. It hung along the axis of the containing vessel from the glass rod to which it was attached. It supported a small stirrup which in turn held a horizontal aluminium wire 9 cm. long and 0.5 mm. in diameter. To this wire was attached, each in the vertical plane of the wire, centrally a light wire carrying a circular plane mirror about 1 cm. in diameter, and flush with each end a rectangular vane of mica, 3.5 cm. horizontally, by 3 cm. vertically.

The heaters were wound on opposite faces of vertical mica frames. Platinum wire 0.1 mm. in diameter was used. The frames were supported in the lateral ground stoppers. Each heater faced a vane of the suspension in such a way that the

turning moments given to the suspension by the two heaters were similarly directed. The area of a vane was somewhat greater than the area covered by the heater which it faced. The heater wire was soldered to copper leads, which in turn were soldered to platinum leads through the glass. The two heaters were joined in series in circuit with a storage cell, an adjustable resistance and a Siemens and Halske milliammeter. The circuit was earthed to remove possible static charges. The instrument was protected from external radiation and from daylight; a vertical section of the apparatus is shown in fig. 1.

Readings were made by means of a millimetre scale placed horizontally, and parallel to the mirror, approximately 45 cm. from it. Beneath the scale was a vertical slit illuminated by a 2-volt miniature lamp. A lens of 40-cm. focal length, 40 cm. from the scale threw an image of the slit reflected from the mirror upon the scale. A null method was used in making measurements. The readings taken when current flowed through the heaters were the number of degrees through which the torsion head of the instrument had to be turned to bring the suspension to its position of equilibrium when no current was flowing in the heaters. This position was indicated by a chosen "zero position" of the image of the slit on the scale.

Measurements were made with the instrument to determine the pressure at which the sensibility was a maximum. Readings were taken of the deflections arising from currents of 5, 10, and 15 milliamperes in the heaters at pressures ranging from 1 mm. to 0.01 mm. The order of readings was 0, 5, 10, 15, 10, 5, 0 milliamperes. A table of data and a curve showing the results of this investigation are given in Table I and fig. 2. This investigation shows the existence of a pronounced maximum of sensibility at a pressure between 0.03 and 0.035 mm. of mercury. In the region of maximum sensibility the instrument was calibrated. The pressure used was 0.0378 mm. of mercury. Readings were taken of the current in the heaters and the deflection of the vanes for currents rising by 2 milliamperes from zero to 17.15 milliamperes and decreasing by the same steps. Table II shows a set of observations and fig. 3 square roots of deflections plotted against currents.

TABLE I.

Pressure (mm.)	Deflection (degrees on torsion head).				
	5	10	15	10	5 milliamps.
2·08	—	7	16	7	1·5
1·07	4	15·5	34	16	4
0·514	6·5	27·5	61	29	7·5
0·235	12	52	117	52	12
0·131	23	84	193	85	23·5
0·0697	26	111	245	111	26
0·0381	31·5	125	272	125·5	31
0·0187	31	120	265	121	31
0·0185	29·5	117·5	255·5	119·5	29·5
0·0096	24	100	207	99	25

TABLE II.

Pressure 0·0378 mm.			Pressure 0·0373 mm.		
Current (milliamps.)	Deflection (degrees).	Square root of deflection.	Current (milliamps.)	Deflection (degrees).	Square root of deflection.
2·0	4	2	15·1	220	14·8
4·25	18	4·24	13·0	159	12·6
6·4	37·5	6·12	10·8	113	10·6
8·7	71	8·42	8·7	72·5	8·51
10·9	111	10·5	6·5	42	6·48
13·0	157	12·5	4·3	17·5	4·18
15·1	212	14·5	2·0	4	2
17·15	275	16·6			

Since the same geometrical relations existed between the heaters and the vanes facing them when readings were taken, the amount of energy falling upon the vanes depended only on the rate at which it was liberated in the heaters. The fact that the curve is a straight line shows that the turning moment upon the radiometer suspension is directly proportional to the energy which falls upon the vanes. It is believed that the device of liberating the energy from electric heaters within the vacuum space has not been employed heretofore to establish this principle.

An attempt was made to increase the sensibility of the instrument by blackening the faces of the vanes adjacent to the heaters with camphor smoke. Readings were made at a pressure of 0.0297 mm., but the deflections showed no rise in sensibility arising from the blackening. Measurements made of the resistance of the two heaters in series when currents of various intensities were flowing through them gave the following results:—

Resistance of heaters.	Current in heaters.
14.54 ohms	0.6 milliampere
14.56 ohms	15.0 milliamperes

In conclusion, there is to be pointed out the possible usefulness of the principle employed in this instrument in an indicator of effective values of currents of rapidly varying direction and intensity. Its use in circuits containing spark gaps in which the added resistances of the heaters would be appreciable is suggested. The instrument is usable only when thoroughly shielded from radiation and mechanical vibration. It has the disadvantage of a complicated construction and rather sluggish action in reaching its final reading.

A CONFERENCE OF RESEARCH ORGANISATIONS.

A scheme for the organisation and development of scientific and industrial research was sanctioned by Parliament in 1915, and involved the formation of a committee of the Privy Council to which was attached an advisory council, the latter being composed of men prominent in industry and others eminent in pure science. Following on the original organisation, industrial associations of manufacturers were formed under the auspices of the Council, and by their co-operation the possibilities of research have become more widely known and better understood. As a consequence of the initial movement, rival scientific research associations were set up, and the eagerness with which they were started indicated that the Government scheme had not met with such general approval as was anticipated.

Those responsible for the Government scheme were, therefore, well advised to call together members of research organisations to deliberate on problems that invited criticism. Such was, apparently, the object of a meeting held at the Board of Education offices on July 29th, under the presidency of Sir W. S. McCormick, LL.D., Chairman of the Advisory Council, when representatives of research associations and other research organisations met members of the Council for Scientific and Industrial Research. The object was to elicit opinion not to issue instructions; and as necessity arises future meetings will be called.

The list of firms and research associations present at the meeting is too long for reproduction, but some 30 were represented. The Italian Embassy and the Belgian Minister both sent delegates, while, in addition to the chairman and secretary (Sir Frank Heath, K.C.B.), Prof. J. A. McClelland, F.R.S., Sir Maurice Fitzmaurice, C.M.G., F.R.S., Sir George T. Bailey, F.R.S., and the Hon. Sir Charles A. Parsons, K.C.B., F.R.S., attended as members of the Advisory Council. The chairman stated that already nine research associations were in being, eight more approved by the department were only awaiting the licence of the B. of T., while the admission of 12 others was still under discussion. Four topics engaged the attention of the meeting: (1) formation of a records bureau; (2) conditions of employment of research workers by research associations; (3) co-operation amongst research associations for the study of accessory materials or equipment; and (4) subscriptions to research associations.

Mr. A. P. M. Fleming, O.B.E. (British Westinghouse Co.), explained the objects of the records bureau as the collection and circulation of all available knowledge about any special industry, but he intimated that it might not be expedient at the present time to initiate such a scheme on international lines. He generally approved the suggestion of the department to undertake only what could be economically handled and made thoroughly trustworthy. He urged that besides circulating the bare records of the Research Associations an effort should be made to preserve the incidental, but often valuable, matter that resulted from a research investigation. Mr. Fleming also called attention to the danger of giving too exclusive attention to the accumulation of masses of indirect or incidental features of information. Collection of such material from foreign research organisations or from obscure sources generally inaccessible to the public was eminently desirable, "but there is a grave risk in launching out and forming a central bureau, extending to work of this kind, of making it instead of a live intelligence department, really a dead museum." Attention was further urged on the desirability of linking up all who were engaged in the work of research. Intercourse was to be encouraged by every means, with the view of removing the evils of secrecy. Under the common menace now threatening industry, secrecy should be reduced to a minimum. The importance of educative influence could not be overlooked, for employers, labour, and the consumer shared alike in the responsibility of encouraging research, and this responsibility was increased by the growing tendency for State aid and State control to interfere with industry.

Major Bliss (Woollen Research Association) urged the need of founding more and better technical libraries in provincial centres. In the absence of such facilities he suggested that arrangements be made for the proposed bureau to transmit copies of, or extracts from, papers on application from research workers.

Mr. C. Beck, C.B.E. (Scientific Instrument Makers), desired some restriction to be placed on indiscriminate publication. It was desirable that the position of individual research associations with regard to work which they had originated should be clearly defined. He admitted that in cases in which different trades had a common interest, communications would be essential to prevent overlapping of work; it was therefore of importance to know what steps the Department proposed to take in order to safeguard the interests of associations already disclosing facts with the view of benefiting the trades concerned. The danger of information deposited with the bureau reaching the hands of competing companies of different nationalities was not to be overlooked.

Mr. A. E. Marlow (Boot and Shoe Research) commented on the unwillingness of Americans to supply intelligence, and suggested that the records bureau might be usefully employed in quickening the interchange of ideas and information.

Mr. J. W. Williamson (Scientific Instrument Makers) expressed anxiety lest the funds of the Department should be absorbed in the formation of a bureau to the detriment of the immediate purposes of experiment and inquiry.

Sir Frank Heath, K.C.B. (Secretary of the Department of Scientific and Industrial Research), in reply, declared that the ownership in scientific results remained in the hands of the members of the Association; each association held that property in trust for its members. Secrecy where necessary could be secured and guaranteed by dividing the bureau into a confidential and non-confidential section. Communications could be sent to either section, but, if sent to the former, the Department would ensure privacy. Information from the bureau would be forwarded to others only with the knowledge and consent of the party depositing the information. But confidential matter might sometimes be of great value to another Research Association, and in that case the bureau would be prepared to negotiate the transference of that information on agreed terms. The Council was alive to the danger of devoting energy to the collection of the dead dry bones of science, and whatever services the bureau could render would be additional, and would entail no burden on the "million fund" earmarked for research. The Department had an annual vote in Parliament as well as the "million fund," and efforts would be made to persuade the Treasury to allow fresh funds to be voted for the purposes of the bureau. It was the primary duty of a research association to have its own library and records bureau. The central authority would not relieve the associations from getting their own information. At all times the central bureau would be ready to assist in distributing matter difficult of access, but it would be unwise to undertake an agency for sending out extracts of papers on all and sundry subjects.

Sir Herbert Jackson, K.B.E., F.R.S., supported collection on the ground that it was desirable to set up some body to act as a kind of trustee of progress and activity on the subject of research. Such a body would keep a watchful eye on the whole amount of national research, and, being in possession of this confidential information, would be competent to spur on others who were not doing what ought to be done, and would survey the whole field.

The second item for discussion affecting the conditions of employment of research workers has been the subject of much hostile comment. Section 14 on the conditions under which grants are made to students found little favour at the meeting.

Alderman J. P. Hinchcliffe (Woollen Research Association) insisted that the success of endeavours in research would depend on the generosity and fair-mindedness with which the agreements with research workers were treated. The investigator should be paid such a salary as to relieve him of all family anxiety, otherwise his mental effort would depreciate. If the confidence of workmen was to be enlisted, careful and generous consideration must dictate the agreement.

Sir F. Heath, K.C.B., read a letter from the director of an engineering research laboratory that criticised the original suggestion. "One general criticism of this pamphlet is that it regards the research worker merely as an individual and not as a member of a team." "The payment of special amounts on account of successful work creates the worst spirit on a research staff. A successful result is hardly ever the work of a single man. Special grants are liable to cause ill-feeling and secrecy and exclusiveness. The director is responsible for assessing pieces of work to different individuals, and it puts him in an unfair position. General individual merit should be rewarded by salary increases, and successful research work should be rewarded by a grant to be divided amongst all members of the research staff whether they have participated in the successful research or not." After some remarks on the position of the director, the writer proceeds on the question of publication. "Whilst it may be undesirable to publish some things the majority of the work done in a laboratory can be published, and every encouragement should be given to prepare papers for publication. When it is undesirable to publish the results of research, there is usually no difficulty in giving an account of the research." Finally the writer insists that it is untrue to say that "the ultimate aim of industrial research is mainly financial profit." "The main object of industrial research is to build up a strong and progressive industry." Very general agreement with the tenor of this letter was expressed.

Mr. W. Greenwood (Cotton Research Association) remarked that where a man was working for a bonus as against a salary, he often lost that real interest in his firm and in his industry that he ought to have; he became obsessed with the thought of how his efforts might affect the reward he would receive.

Sir George T. Beilby, F.R.S. (Director of Fuel Research), pointed out that it was a very difficult and dangerous practice to begin apportioning the special share of credit to each member of a research staff to be followed by a money payment. Special bonuses tended to make men narrow-minded, and nothing was thought of but to make that particular department successful, and to show how much was saved.

Sir Herbert Jackson, K.B.E., F.R.S. (Scientific Instrument Research), viewed with consternation the proposal to give any kind of bonus. On any research work being done, it was better for all concerned to meet and discuss it, so that each mind might bring its little bit of knowledge to the sum total. Such mutual assistance would have to stop instantly: "the only way is to remember, that when you get a good man you should pay him well, and when you have got your good man, give him a feeling of security of tenure by increasing his salary."

The Secretary invited opinion upon the difficulties that might arise, if a worker wished the result of his work to be patented and the Association declined to give permission.

Lieut.-Col. M. O'Gorman (British Aircraft Constructors) related his experience in trying to prepare some form of agreement which might be accepted, both by engineers and by employing firms; and admitted the difficulty of the position outlined by the secretary. He did not think that firms attempted to touch the inventions of their workpeople; the workman came in without agreement, and was free to protect what he pleased. Higher skilled men were generally bound by agreement to assign their devices and inventions to the firm, leaving it to the generosity of the firm to make a reward. This he regarded as a perfectly good arrangement, but it did not meet the case of the aggrieved worker who was prevented from patenting on his own behalf. He did not think that the individual inventor should be rewarded *ad hoc* for his invention, when he was a whole-time employé of a firm, and this opinion met with general approval. The proof of good organisation was team work, and the death of team work was individual pulling against one another, working up secrets and then crystallising them into a patent, in order to put it before the management in the hope of getting a money reward.

Mr. W. Dixon (Manufacturers' Research) gave, as a possible solution, a plan whereby all employés had a right to patent their own ideas on the condition that the employers had a free use of the patent for all time. The share of the employer was a free use of the inventions of all the employés, but the patent part was the property of the patentee.

The Hon. Sir Charles A. Parsons, K.C.B., F.R.S., claimed that a man was quite at liberty to patent things done in his own time, which he was not employed upon, and which had no connection with his employer's business, but had no right to apply for a patent for anything in connection with the employer's business.

Alderman J. P. Hinchcliffe considered that a financial inducement was necessary to prevail on a workman to give of his best.

Mr. Napier Prentice (Diesel Oil Engine Users) contended that the true inventor did not carry out his researches for a money reward. This Research Association need not give him a pecuniary remuneration for his work, but it should encourage him to proceed with his schemes.

Lieut.-Col. M. O'Gorman introduced the third subject on the agenda paper, the desirability of co-operation amongst Research Associations for the study of accessory materials or equipment. He compared co-operation with the quarry material used to build up the greater edifice in which all research associations took part. Co-operation was directed in industrial organisations to secure industrial advantages, which might be obtained by what was apparently a gratuitous sharing with others of the good things collected by one's own efforts. Where the industries did not compete with one another co-operation for the common end could more easily be initiated than where there was competition, and therefore it was for the study of accessory materials that one might hope more easily to get co-operation for research. Progress in one branch of industry proved to be profitable to many others quite disconnected.

Sir Frank Heath was inclined to favour the proposal, that joint committees should be appointed to include representatives of a number of associations, and that these joint committees should have specific problems referred to them, and that by agreement between the various associations contributions should be made to finance the investigations. There must be many subjects, where several research associations were directly interested in some particular, which though it might not be the main product of the industry was yet of great importance to all. His proposal was, that committees *ad hoc* should be set up to learn whether this was the most successful way of proceeding.

Alderman Hinchcliffe suggested that in the case of allied associations having a common interest, each should elect two or three members to serve on the associations of the others. The points of contact with the several combining associations would be easily recognised, and that association would be appointed to carry out the research that was best adapted for the purpose.

Sir W. J. Jones, K.B.E. (British Refractories), introduced the fourth subject, subscription to research associations, and pointed out that the success attending the formation of associations depended on securing sufficient subscriptions from the industry immediately interested. The recommendations of the Department were open to grave objections. Schemes had been suggested as a basis for determining the amount of subscriptions including a levy on (1) total capital; (2) average annual profits; (3) annual wage bill; (4) number of employés; (5) volume of the output; (6) value of output; and (7) amount of plant. Objections could be raised to each of these; every one involved the disclosure of facts appertaining to the business of individual firms. It was equally easy to raise objections to the voluntary system, since it encouraged applications to firms outside the industry itself, and was liable to entail a duplication of applications for subscriptions, that might weaken the active interest which each firm in an individual industry ought to feel for its particular Research Association. But time and experience must correct anomalies and remove difficulties. The formation at the moment of

a kind of super-association to be built up out of and on top of these Research Associations could not be approved.

Mr. W. Greenwood (Cotton Research Association) thought that by voluntary subscriptions sufficient security of tenure was not assured to those who were employed in research work, to which Sir W. Jones replied that each subscription was accompanied by a guarantee for its continuance for five years.

Sir Frank Heath thought that confusion would follow the adoption of different policies. He believed that eventually voluntary assessment would be based on some uniform procedure to be discovered by the Association itself. He did not think that any pecuniary difficulty would arise from lack of uniformity, and congratulated the Council on refusing to prescribe a uniform procedure.

The meeting concluded with the usual votes of thanks.

NEW PATENTS APPLIED FOR, 1919.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

19,838. "Electric contact breakers." J. Bernard. August 4th. (France, June 5th, 1917.)

19,999. "Electric cable attachment for sparking plugs." H. F. Holworthy. August 14th.

20,237. "Electrical switches." C. F. Newey. August 18th.

20,252. "Thermionic amplifiers." J. Scott-Taggart. August 18th.

20,260. "Automatic push telephone apparatus." W. P. Thompson. (Haines.) August 18th.

20,261. "Automatic push intercommunication telephone apparatus." W. P. Thompson. (Compagnie Generale de Telegraphie et de Telephonie.) August 18th.

20,269. "Vacuum tube devices for wireless telegraphy." J. Scott-Taggart. August 18th.

20,279. "Dynamo-electric machinery." J. W. Burleigh and Lo-Thermo Patents, Ltd. August 18th.

20,284. "Controlling apparatus for electrically-operated hoisting mechanism, &c." British Thomson-Houston Co. and R. D. Given. August 18th.

20,288. "Wireless reception apparatus." J. Robinson. August 18th.

20,313. "Sparking plugs." R. Breton. August 18th. (France, June 4th.)

20,325. "Electric switches." A. Pouchain. August 18th.

20,343. "Sparking plugs." W. Miller. August 19th.

20,360. "Combined direct and indirect lighting fitment." S. S. Galsworthy. August 19th.

20,368. "Combined electric bell and battery." S. R. Brown. August 19th.

20,369. "Internal-combustion engine ignition distributor, commutator or timer." J. Crane. August 19th.

20,371. "Shade carriers for electric lamps." D. L. de Mole. August 19th.

20,384. "Combination ignition switch for petrol-driven vehicles." F. E. Ewer and P. A. Tellinghast. August 19th.

20,387. "Telephone exchange systems." G. Deakin and Western Electric Co. August 19th.

20,398. "Wireless telegraph transmitters." H. J. Round. August 19th.

20,399. "Wireless direction finders." H. J. Round. August 19th.

20,400. "Electric lamp." E. L. Thompson. August 19th.

20,412. "Electro-magnet circuit interrupters." Ruthardt & Co. August 19th. (Germany, March 19th.)

20,442. "Gravity controlled mercury contact maker for controlling electrical circuits." W. H. Birket and R. H. Parker. August 20th.

20,444. "Sparking plugs." W. A. Tait. August 20th.

20,460. "Selecting devices for automatic telephone systems." E. A. Petithory, J. E. Collyer and Siemens Bros. & Co. August 20th.

20,478. "Device for securing electrical cables, &c., to walls." G. H. Scholes. August 20th.

20,482. "Ignition devices." J. S. Coyle. August 20th.

20,487. "Sparking plugs." J. Bartholomew and R. Rutherford. August 20th.

20,491. "Incandescent lamps." J. S. Withers. (Schlesinger.) August 20th.

20,505. "Electric switches." A. G. Thornton. August 20th.

20,506. "Electric couplings." E. H. Fuller and Ross, Courtney & Co. August 20th.

20,513. "Electrical indicators for railway, &c." J. Gardner. August 21st.

20,518. "Electric furnace for continuous heating of rivets, &c." A. Imbery. August 21st.

20,531. "Alternating current relay." Automatic Telephone Manufacturing Co. and G. W. Flynn. August 21st.

20,535. "Electric fuses." H. F. McLouglin, Simplex Conduits, Ltd., and L. M. Waterhouse. August 21st.

20,542. "Welding electrode holders." E. E. Daglish W. L. Lorkin and H. B. Swift. August 21st.

20,544. "Dynamo electric machinery." T. L. R. Cooper. August 21st.

20,548. "Electric signalling systems." Western Electric Co. (Western Electric Co.) August 21st.

20,588. "Cases, &c., for spark plugs." R. S. Grose. August 21st.

20,601. "Electrical resistance units." Abbot Turner & Co. and C. C. Turner. August 21st.

20,605. "Obtaining currents of two periodicities from one generating unit." H. A. L. Bakry. August 22nd.

20,612. "Memorandum devices for use with telephones, &c." J. M. Hattersley. August 22nd.

20,637. "Electric relays." Automatic Telephone Manufacturing Co. and A. E. Hudd. August 22nd.

20,628. "Telegraph printing systems." Automatic Telephone Manufacturing Co., H. H. Harrison and S. R. Smith. August 22nd.

20,635. "Locking device to prevent use of electrical mechanism." D. Byrne. August 22nd.

20,644. "Magneto-electric devices for operating clutches, &c." C. F. Shanks and M. Walker. August 22nd.

20,645. "Magnetically-operated friction clutch." C. F. Shanks and M. Walker. August 22nd.

20,662. "Electric hoisting or winding apparatus." British Thomson-Houston Co. (Compagnie Francaise, Thomson-Houston.) August 22nd.

20,669. "Electric ignition apparatus for internal-combustion engines." M.-L. Magneto Syndicate and E. A. Watson. August 22nd.

20,687. "Electrical furnaces." A. Eimer. August 22nd.

20,688. "Electric ovens." E. L. Smalley. August 22nd.

20,696. "Locking device for electric and gas fittings." J. H. Collings. August 22nd.

20,722. "Automatic electric water-heater." E. T. Hayes. August 23rd.

20,739. "Electric hooters, &c., for motor vehicles, &c." E. Baucourt. August 23rd.

20,760. "Senderless automatic telephone satellite systems." G. Deakin and Western Electric Co. August 23rd.

20,775. "Current distributors of electric ignition systems, &c." J. H. Runbaken. August 23rd.

20,776. "Magnetos." J. H. Runbaken. August 23rd.

20,784. "Production of caustic soda from brine by electrolysis." J. K. Nair. August 23rd.

20,789. "Magneto carrier, &c." F. R. Simms and Simms Motor Units, Ltd. August 23rd.

20,790. "Miners' electric safety lamps." T. Stretton. August 23rd.

20,790-1. "Miners' electric safety lamps." Haslam & Stretton. August 23rd.

20,791. "Miners' electric safety lamps." J. W. Jones. August 23rd.

PUBLISHED SPECIFICATIONS.

The numbers in parenthesis are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

19,108. Electro-magnetic methods of detecting submarines. R. Beattie. December 27th, 1917. (130,350.)

1918.

1,833. Telegraphic and other instruments and installations. J. Hettinger and C. A. Vandervell. January 31st, 1918. (Cognate application 7,948/18.) (130,368.)

1,886. Wireless signalling systems. British Thomson-Houston Co. (General Electric Co.) February 1st, 1918. (130,369.)

2,030. Electric contacting devices controlled by sound, waves and the like. A. C. Heap and A. B. Field. February 4th, 1918. (130,375.)

2,031. Acoustically-operated electric contact actuating mechanism and systems employing the same. A. C. Heap and A. B. Field. February 4th, 1918. (130,376.)

2,746. Electron discharge devices. British Thomson-Houston Co. (General Electric Co.) February 15th, 1918. (130,400.)

2,796. Electric relays. L. B. Turner. February 16th, 1918. (130,408.)

3,344. Means for detecting small electric currents. J. S. E. Townsend. February 23rd, 1918. (130,429.)

7,252. Electrical signalling systems. Western Electric Co. (Western Electric Co.) April 30th, 1918. (Convention date not granted.) (130,432.)

8,941. Dynamo-electric machinery. J. W. Burleigh. May 30th, 1918. (130,425.)

10,535. Ignition plugs. W. F. M. Edwards. June 26th, 1918. (130,438.)

11,613. Electric lamp holders and the like. H. T. Wilkinson and Wardle Engineering Co. July 16th, 1918. (130,441.)

12,125. Process for electro-plating metals, and particularly for copper-ing iron and steel. Q. Marino. July 25th, 1918. (130,446.)

12,315. Electro-magnetic speed-changing gear. Menco-Elma Syndicate. September 22nd, 1917. (119,651.)

12,322. Electro-pneumatic braking systems. British Thomson-Houston Co. (General Electric Co.) July 29th, 1918. (130,451.)

12,369. Sparking-plugs for internal-combustion engines. J. K. White and Baynes & Partners. July 30th, 1918. (130,452.)

12,593. Constant current dynamos. Trier & Martin, V. A. Trier and S. Smith & Sons. August 1st, 1918. (Addition to 5,632/10.) (130,473.)

13,314. Apparatus for measuring the average maximum demand in kilovolt amperes from an alternating current supply. A. E. Jepson and O. Howarth. August 16th, 1918. (130,485.)

13,510. Signalling on primaries of telephone or telegraph phantom circuits. E. S. Ritter. August 20th, 1918. (130,489.)

13,536. Means for determining the direction of a distant source of electro-magnetic radiation. R. E. Ellis. (F. Adcock.) August 21st, 1918. (130,490.)

13,580. Form of portable electric lamp. A. R. Upward. August 21st, 1918. (Cognate application 17,038/18.) (130,491.)

14,079. Electric furnaces. A. D. Keene. September 5th, 1917. (119,238.)

14,815. Electrically-operated pulley blocks hoists and the like. H. Morris, Ltd., G. A. Robertson and W. N. Weston. September 12th, 1918. (130,500.)

15,782. Diaphragms for gramophones, phonographs, telephones, and the like. A. T. Collier. September 28th, 1918. (Cognate application 7,815/19.) (130,507.)

16,261. Means for attaching shades or globes to electric lamp holders. T. Cracknell. October 7th, 1918. (130,511.)

17,386. Sparking plugs for ignition purposes. A. E. Heath. October 24th, 1918. (130,516.)

17,731. Electrically-heated fabrics. A. S. Lucas. October 30th, 1918. (130,518.)

18,078. Electro-magnetic wave-signalling systems. N. Lea. November 4th, 1918. (130,520.)

1919.

1,071. Electric batteries. S. F. Tyler and E. H. Naylor. January 15th, 1919. (130,545.)

2,485. Ignition systems. Splitdorf Electrical Co. December 28th, 1916. (123,077.)

3,361. Machine for use in electric welding. A. Faure. February 11th, 1918. (123,320.)

3,990. Automatic cut-in and cut-out electric switches. Fuller Accumulator Co. and A. P. Welch. February 18th, 1919. (130,557.)

5,559. Spark plugs. E. M. Johnson. March 6th, 1919. (130,564.)

6,308. Sparking plugs for internal-combustion engines. L. M. J. S. Bour. June 29th, 1918. (129,256.)

12,594. Sparking plugs for internal-combustion engines. H. W. Carpenter. May 17th, 1918. (127,253.)

Heating Water Electrically.—In *E.T.Z.* for June 12th last, it is shown that heating water electrically for industrial and commercial purposes is economical, and that its use is of special importance in areas supplied by long-distance transmission. An apparatus is described that is manufactured by A. Ritterhaus, of Kassel. It takes 3 kw., and is provided with a thermostat, by which the current is interrupted when the water reaches a given temperature. The average daily consumption in a given year was 15.4 units, and the maximum consumption on any one day 22 units, and the average number of hours of use per day about 6 hours.